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K.C.S.-L. & A. "Southern Belle"

Three four-car trains built of aluminum alloys and driven by Diesel-electric locomotives

EARLY in September the Kansas City Southern-Louisiana & Arkansas Lines placed in operation between Kansas City, Mo., and New Orleans, La., the new four-car passenger-streamliner Southern Belle.

The schedule calls for 25 stops in the 868-mile run between terminals, the overall running time being 21½ hr. and the average speed slightly over 40 miles an hour.

To maintain daily schedules in each direction, three Southern Belle trains are required. Each train consists of a Diesel-electric locomotive, a mail-baggage car, a chair car, a Pullman sleeper, and an observation-parlor-diner car. The single-unit 2,000-hp. locomotives were furnished by the Electro-Motive Corporation. The cars for each train were designed and built by the Pullman-Standard Car Manufacturing Company, strong aluminum alloy being used as the principal structural material to secure a high strength-weight ratio. Individual car dimensions, weights and seating capacities are given in one of the tables.

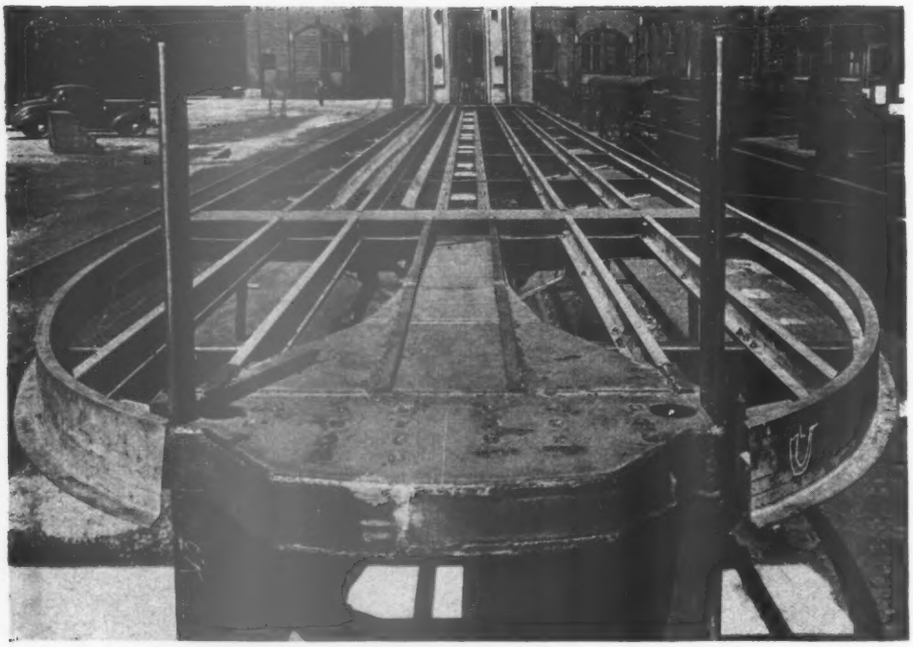
Both the exterior and interior of the Southern Belle were designed by Pullman-Standard stylists in close co-operation with Harvey Couch, chairman of the board of the K. C. S.-L. & A. The exterior design presents the latest refinements in structural streamlining, accented by the use of a striking and unusual color scheme. The front end of the Diesel-electric locomotive uses vivid red and yellow for visibility, in contrast to the dark green background. The red and yellow are carried in sweeping curves, giving an impression of speed and power, and adding materially to the streamline effect.

The cars have aluminum-colored roofs, with the car bodies in dark green, and carry at the girder sheet a wide yellow stripe with a wide vivid red stripe placed just above. These striping colors are carried in uninterrupted lines from the locomotive, giving the effect of continuity to the train, and by this use of color making a striking and complete unit of the train in its entirety. The aluminum of the roof is separated from the dark green of the car body by a narrow red stripe, and the exterior lettering on the train is in imitation gold color.

The interior design of the passenger cars creates an impression of extreme simplicity, coupled with efficiency and good taste in selecting materials and decorations.

Special features of the car equipment include Pullman electro-mechanical air conditioning; large wash rooms and luggage compartment at each end of the chair car, allowing a more advantageous spacing of seats; a day room and secretary's room in the observation-lounge-diner car for convenience of passengers and crew; a settee on one side of the aisle and seats with table on the other in the front part of the chair car for convenience and comfort of passengers; photo-murals in the observation-lounge-diner car and chair cars showing scenes along the route; master radio with speakers in all parts of the train, each speaker equipped with variable volume control; telephone connection for use with regular Bell system during stops along the line; large clock in observation-lounge-diner cars and chair cars; telephone connection between all cars and the locomotive for inter-train communication; private office for conductor at the front of each chair car equipped with desk, cabinet for papers, telephone for communication with engineman and other cars; wash room, including shower bath, for crew in mail-baggage car.

The observation-lounge-dining car is divided into six



An observation-car underframe in process of construction

main sections, from front to rear: two day rooms, 10 ft. 7 in.; lunch room, 7 ft.; kitchen, 11 ft. 4 in.; dining room, 12½ ft., seating 16; parlor, 17½ ft., seating 17; and observation room, 11½ ft., seating 8.

Many details designed to increase the comfort and convenience of the passengers have been incorporated in the chair cars. The seating capacity of each chair car is 74, 56 in the 48-ft. white compartment and 18 in the 17-ft. colored compartment.

The baggage compartment in the front half of the mail-baggage car is 38 ft. 4 in. long. A partition with a low creep door separates it from the 30-ft. mail compartment, which is equipped with Railway Mail Service racks, compartments, etc., for working mail while the train is enroute.

A 9-ft. 9¾-in. section at the rear of the car is designed to supply comfortable sleeping and toilet accommodations for the crew.

One sleeping car is operated in the southbound train from Shreveport to New Orleans, and another sleeper in the northbound train from New Orleans to Shreveport. The sleeping cars are of the ten-section, three-double-bedroom floor plan.

Lighting

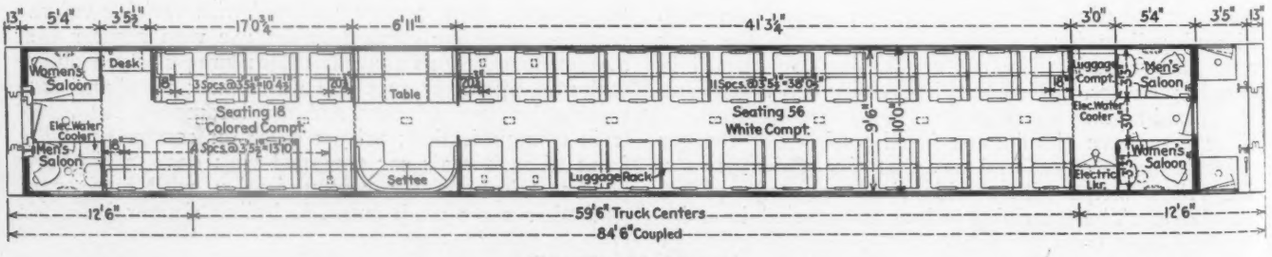
The chair cars have individually controlled lights placed on the lower side of the basket racks, one light to each seat. In addition to this, and for general illumination, center lights are used at the ceiling and, by a unique lens system, are so designed to focus the light on the aisle only. These lights are glareless to the passengers, even though the passengers may be in reclining positions. Blue night lights are also provided to give further distinction to the lighting system.

The same general type of controlled-lens lighting is used in the vestibules, passageways, lunch room and day rooms, and in the observation room. In the lunch room and observation room these lensed ceiling units are arranged in a pattern to follow the room contour of the observation end and the lunch counter contour in the lunch room, and are further accented by satin-finish snap moldings placed on either side, with a distinctive color band in the central portion.

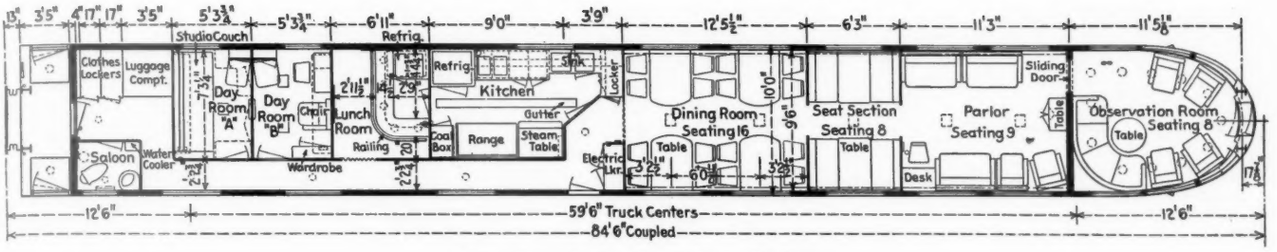
The dining room and lunch room, in addition to the lensed center lighting, have continuous side lighting running from bulkhead to bulkhead, placed just over the windows on either side of the room. This gives a very decorative effect because the light is directed up to the ceiling and down to the dining tables and lounge furniture through translucent plastics. To add further to the appearance, strips of the same plastic material are inserted in the front of the fixture, thus creating luminous lines running the length of the unit.

Construction Details

The 11 railroad-owned cars, consisting of 3 mail-and-baggage cars, 5 chair cars and 3 observation-parlor-diner cars, embody the same general structural design and are made of fabricated aluminum alloys, except for the draft sills, bolsters, end sills, and cross ties, draft lugs and diaphragm post reinforcements, which are of alloy steel. The shell weight of one of the coaches, as determined by track scales, was only 20,113 lb. The car structure is designed to comply with the present requirements of



Floor plan of the coach



Floor plan of the observation-parlor-diner

the Association of American Railroads for new passenger cars, including resistance to minimum static end load of 800,000 lb. applied on the center line of draft. The cars are of riveted construction, all exposed rivets being aluminum with mushroom-type heads.

The general type of underframe consists of two main center sills of 12-in. aluminum-alloy channels, reinforced with ⅝-in. aluminum-alloy bottom plate. These center sills extend from bolster to bolster. The bolsters and end construction are welded alloy steel. Floor stringers, false floor and main floor consist of aluminum alloys. The main floor is Pullman arch construction, with Fiberglas insulation and lightweight composition flooring. Linoleum is applied in the chair cars and carpet in the observation-parlor-diner. All threshold plates are made of cast aluminum, with special anti-skid surface.

Principal Dimensions and Weights of "Southern Belle" Aluminum Alloy Cars

	Mail—baggage	Chair car	Observation—Parlor—diner
Length over buffers, ft.	84½	84½	84½
Width over side posts, ft.	10	10	10
Roof height above rails, ft.	13½	13½	13½
Truck centers, ft.	59½	59½	59½
Truck wheel base, ft.	9	9	9
Journal size (roller bearings), in.		5½ by 10 (all cars)	
Seating capacity	..	74	41
Body light weight	58,900	66,750	67,750
Truck weight (2)	37,300	38,000	38,000
Total light weight	96,200	104,750	105,750
Water, ice, provisions, etc.	2,000	2,000	6,500
Weight ready for service	98,200	106,750	112,250

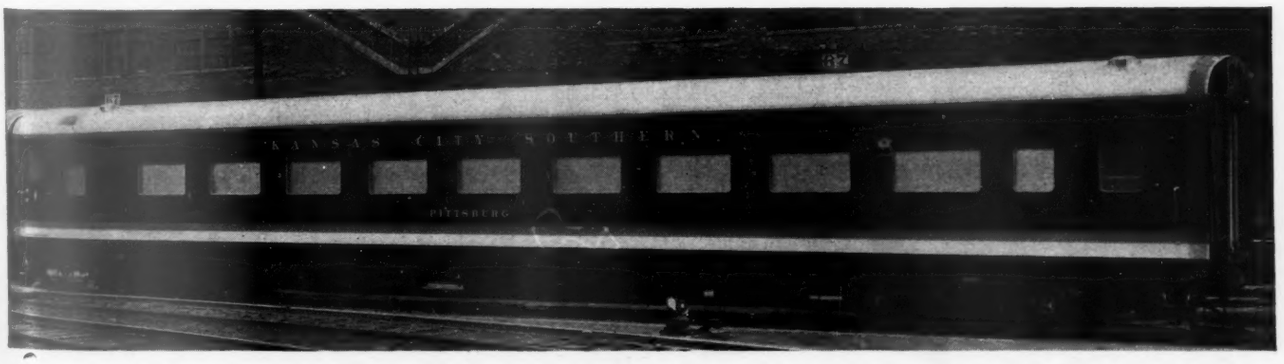
The side framing is of the self-supporting type, riveted-girder design, of aluminum-alloy sheets and shapes, with skirts below the side sills separately applied. The vestibule construction for the wide and dummy-type vestibules also is made of aluminum alloys. The turtle-back type of roof is continuous from end to end of the cars, without hoods, except the rear end of the observation-parlor-diner cars, which have a sloping hood to conform to the streamline shape of the train.

The cars are completely insulated with Fiberglas insulation, held in place with aluminum bands. All safety appliances have been provided to meet Interstate Commerce Commission requirements for these types of cars.

The draft gear, buffing device, and drawbars are of the A. A. R. tight-lock type, with integral yoke, designed to absorb lost motion and provide easy starting and stopping characteristics without jerk or jar. The vestibule side doors, of the Pullman pivoted-type, operating in conjunction with trap doors, are arranged to close up and hide the steps when the doors are shut. All steps

(*Continued on page 539*)

Interior of one of the chair cars



The cars have straight and smooth car sides, wide windows and are finished in brilliant colors

High-Speed Locomotive

Cylinder-Power Measurement[1]

By L. K. Botteron[2]

The limitations of mechanical indicators in determining the indicated horsepower of high-speed locomotives—The heat-drop method employed by the Union Pacific in road tests

STEAM locomotives now run for short periods at speeds in excess of 100 m. p. h. Speeds of 90 m. p. h. for sustained periods are not unusual. Running over a division at 75 m. p. h., with the exception of the acceleration and deceleration periods in stopping, starting, and observing local speed restrictions, is common practice. At diameter speed, the driving wheel rotates at 336 r. p. m.; high-speed passenger locomotives operate a considerable part of the time at higher than diameter speeds. Considering the size of locomotive cylinders, the rotational speeds are high as compared with other reciprocating engines.

The difficulties encountered in taking indicator cards on high-speed steam locomotives are many and it must be borne in mind that, compared with indicating stationary engines, the problems encountered are far more complex. Reducing motions are a constant source of trouble due to breaking and rapid wear as they must run unprotected from the weather. Due to roadway clearances and interferences of locomotive parts, it is often difficult to apply any sort of a reducing motion. Common to all indicators driven with a reducing motion, the stretching of the indicator cord increases as the speed increases, the indicator-drum spring is hard to adjust correctly, and even the drum is a source for errors due to its inertia. L. Pendred, in an article [3] on high-speed indicators, does not believe any reciprocating reducing motion is reliable above 500 r. p. m. In the case of steam locomotives, this limit more likely would be 300 r. p. m. Mechanical indicators of simple and rugged construction for speeds up to 500 r. p. m. are on the market but, if the indicator-drum motion does not proportionally follow the crosshead, the cards are of little or no value.

Since reducing motions, cord stretch, and drum inertia are such a source of error, the thought arises that it might be better to dispense with the reducing motion entirely and drive the drum at constant speed in one direction. In this case it would be necessary to apply an apparatus for marking crosshead dead centers on the card. Also, the drum speeds would have to be high as shown by the following example:

A locomotive with 80-in. drivers, at a speed of 100 m. p. h. is making 420 r. p. m., which completes a cycle in $\frac{1}{7}$ sec. To obtain cards 3 in. long, paper travel of $1\frac{3}{4}$ ft. per sec. would be required.

The errors common to the mechanical indicator are well covered in technical literature. On the steam locomotive, all of the mechanical-indicator errors and troubles common to stationary work are encountered plus some additional ones. The most troublesome of these are the severe rapid vibrations of the front end of the locomotive at high speeds. Front-end vibration will in turn vibrate the entire indicator and especially disturb the pencil motion. Sticking pistons are common, due to highly superheated steam and bits of boiler scale and other foreign matter getting into the indicator cylinder. The operator labors under conditions which are not conducive to good work and, furthermore, there is the hazard of striking obstacles such as vehicles or animals. There is also the possibility of the locomotive meeting with an accident that would result in knocking out a cylinder head.

Due to clearance limits, indicators usually cannot extend out beyond the width of the cylinders. This means that indicators cannot be connected directly into the cylinders. Instead, relatively long pipes must be used between the cylinder and the indicator in order to locate the instrument so that it is accessible to the operator and within clearance limits. The errors due to long pipes are very serious and at high speeds the events, as shown by the card, lag so far behind the actual events in the cylinder as to make the card valueless both for the events and for the determination of the mean effective pressure.

Mechanical indicators, developed primarily for internal-combustion-engine testing, offer possibilities for high-speed steam-locomotive testing, provided the drum is driven at constant speed and not by a reducing motion. However, the errors due to long pipes and locomotive vibration would still be present, and the operator would have to ride the front end. Pressure-time cards instead of pressure-volume cards would be obtained and, to determine the m. e. p., it would be necessary to redraw the cards on a pressure-volume basis unless a special integrator were available.

Optical indicators do not seem to offer any possibilities for locomotive road tests. They are essentially laboratory instruments and are not rugged enough to stand shocks and vibrations.

Electrical-Type Indicator

The indicator which offers possibilities for determining the indicated horsepower of high-speed steam passenger locomotives is the electrical type, such as the Martin and Caris indicator,[4] the indicator described by H. T. Sawyer,[5] and the indicator advertised by the General Electric Company.[6] With the electrical indicator, the only apparatus required on the locomotive are the pressure-measuring heads, an electric dead-center marker, and wiring running back to the test car. The oscillograph, which is the recording instrument, would

[1] Abstract of paper contributed by the Railroad Division and presented at the semi-annual meeting of the American Society of Mechanical Engineers, at Milwaukee, Wis., on June 17-20, 1940.

[2] Engineer of road tests, Union Pacific.

[3] "High-Speed Engine Indicators," by L. Pendred, Engineering, vol. 115, January 26, 1939, pp. 119-121.

[4] "A New Electrical Engine Indicator," by E. J. Martin and D. F. Caris, S.A.E. Journal, vol. 23, July, 1928, pp. 87-97.

[5] "An Indicator for High-Speed Engines," by H. T. Sawyer, Mechanical Engineering, vol. 58, May, 1936, pp. 283-285.

[6] "To Measure Pressure Electrically," advertisement of General Electric Company, Mechanical Engineering, November, 1939, ad. p. 7.

be carried on the test car. The electrical indicator therefore possesses many inherent advantages over other types. The pressure-measuring heads are attached directly to each head of each cylinder, thereby eliminating the error due to piping; any number of cylinders can be indicated simultaneously; reducing motion is not used, and the operator is not required to ride the front end.

Conditions which might interfere with the accuracy of the electrical indicator are the effects of vibration and temperature differences on the pressure-measuring heads. The electrical indicator makes only pressure-time cards, but with a special integrator the m. e. p. of such cards may be directly determined.

Heat-Drop Method of Measuring Indicated Horsepower

Due to the limitations of mechanical indicators and the hazard of men riding the front end, the research and mechanical-standards department of the Union Pacific has used the heat-drop method for determining the steam rates and indicated horsepower of high-speed steam passenger locomotives. The methods of Arthur Williams [7] have been followed and the results obtained for high-speed work have been found to be reasonably accurate.

Briefly, the heat-drop method is based on the first law of thermodynamics. Thus in the case of the steam locomotive, the difference between the total heat in the steam to the cylinders and the steam exhausted from the cylinders is converted into mechanical work regardless of the processes which go on in the cylinder. The question has been raised as to the proper location of thermocouples for measuring exhaust-steam temperatures and it has been pointed out that the state of the steam during the exhaust period is variable.[8] The most reasonable location for the exhaust-steam thermocouples is in the exhaust-nozzle stand, since the exhaust pressure at that point has the least pulsation and the steam has had time to mix. The heat content of the exhaust steam cannot change between the valve chamber and the exhaust stand except for the influence of radiation and kinetic energy. If these two items are corrected for and the pressure and the temperature of the exhaust steam are accurately determined in the exhaust stand, it seems that a reasonably accurate determination might be made of the total energy.

The heat-drop method determines the steam rate only. In order to calculate the indicated horsepower, it is necessary to know the steam to the engine as well as the steam rate.

Knowing the pressure and temperature of the steam in the exhaust-nozzle stand, it is a simple matter to calculate the flow through the nozzle, provided the coefficient of discharge is known. Of course, all formulas for steam flow are based upon steady conditions and some doubt will arise as to whether the formulas hold true for locomotive conditions where the flow is pulsating. For low speeds, the pulsations are of such magnitude that the flow computed from the back pressure will be high. However, at high speeds, the exhausts are so frequent and the pressure fluctuations of such small magnitude that the gage will read an average pressure, accurate enough for calculating the flow.

The exhaust-pressure gage should be piped up so as to have a constant hydrostatic head. This can be done by running a pipe vertically from the side of the nozzle stand through the smokebox and terminating the pipe within the clearance limits. At this point, a coil of copper pipe is connected into the vertical pipe and a pipe with a gradual drop is run from the coil to the gage in the cab. The vertical pipe should be one inch or larger to be self-draining. Either a mercury manometer or a suitable Bourdon-tube gage may be used for indicating exhaust pressure in the cab.

A potentiometer will be found to work very satisfactorily for the determination of the temperatures, if the galvanometer is removed from the instrument and attached to the data board which is held by the operator when taking readings. Arthur Williams in his paper [7] illustrates and discusses such a mounting. During a test it is imperative to remove all auxiliary exhausts from the exhaust passages, as the exhaust steam from the auxiliaries is in a different state from the exhaust steam from the engines. Of course the exhaust-steam temperature taken in the exhaust stand must be the temperature of the exhaust steam from the engine only. Also, by removing the auxiliary exhausts from the exhaust passages, the steam to the engines equals the steam through the nozzle in the case of locomotives equipped with live-steam injectors while, in the case of locomotives equipped with feedwater heaters, the steam to the engines equals the steam through the nozzle plus the steam condensed from the exhaust passages for feedwater heating.

No definite data can be given which will cover the coefficients of discharge of locomotive-exhaust nozzles due to such a wide variety of nozzles being used. Each railroad would have to determine the characteristics of its own nozzle. In general, it will be found that for steady conditions round-hole nozzles without sharp edges or projections and having a smooth approach in the stand have coefficients of about 0.97 to 0.98 for their entire pressure range, while nozzles with complicated shapes and sharp edges have coefficients of 0.8 and lower at low back pressures with the coefficient increasing up to a maximum of about 0.93 at a pressure of 12 lb. per sq. in.

The author calculated the flow through the plain round-hole exhaust nozzle of Baldwin locomotive No. 60000, considering the flow adiabatic and using a coefficient of discharge of unity, but making no allowance for the velocity of the steam in the exhaust pipe.[9] The calculated results, compared with the test-plant measurements, show that, for exhaust-pipe pressures from 9.1 to 19.8 lb. per sq. in., calculated flows are from 3.59 per cent too high to 3.42 per cent too low, with an average of 0.62 per cent too low.

Equipment and Procedure for Heat-Drop Method

The equipment and procedure required for the use of the heat-drop method are simple. It is only necessary to measure steam-pipe and exhaust-stand pressures and temperatures accurately.

The indicating potentiometer is a simple rugged instrument. If any wiring becomes broken, disconnected, or grounded, the potentiometer galvanometer cannot be balanced. Thus there is no possibility of false readings. Only one operator is required and by placing the potentiometer and pressure gages in the cab the operator is removed from the front end to a safer location. The heat-drop method has the advantage over all other methods as it determines both instantaneous steam rate and indicated horsepower. A set of readings can be worked up in about 20 min.

[7] "Measurement of Steam Rate and Indicated Horsepower of Locomotives," by Arthur Williams, Trans. A.S.M.E., vol. 57, 1935, p. 495. An abstract of this paper was published in the January, 1936, issue of the *Railway Mechanical Engineer*.

[8] "Measurement of Steam Rate and Indicated Horsepower of Locomotives," by Arthur Williams, discussion, Trans. A.S.M.E., vol. 58, 1936, pp. 250-256.

[9] "Locomotive Back Pressure," by L. K. Botteron, *Railway Mechanical Engineer*, vol. 104, July, 1930, pp. 400-403.

Lightweight, All-Welded

C.M.St.P. & P. 50-Ton Box Cars

Double-deck loading arranged for in 25 cars—Eighteen have special fabricated steel floor plates

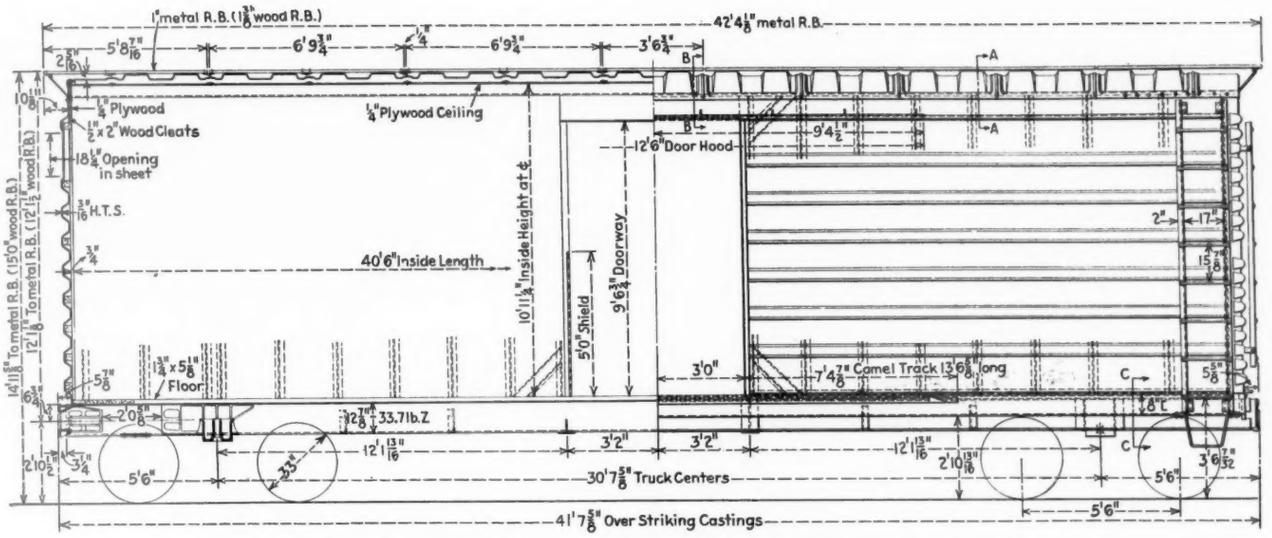
DOUBLE-deck, or even triple-deck, loading can be made in 25 of a lot of 3,188 50-ton, 40-ft. 6-in. box cars recently completed at the Milwaukee, Wis., shops of the Chicago, Milwaukee, St. Paul & Pacific. Except for length, the use of two cross-bearers instead of four, door arrangement, and other minor refinements, the 3,188 cars are fundamentally the same in construction as the automobile cars described in the July, 1937, *Railway Mechanical Engineer*, page 327. They are of the double-sheathed, all-welded type, light weight being obtained by the use of low-alloy high-tensile steels in the underframes, sides, and lower section of the two-piece steel ends. Eighteen of the 3,188 cars have special fabricated steel floor plates which cover the entire wood floor and are perforated with round holes. To prevent moisture and dirt getting into these openings a special asphalt is used having a consistency soft enough to allow driving of nails. These plates, supplied by the Standard Railway Equipment Company, are designed to form a permanent floor construction which will require no further maintenance cost throughout the life of the car.

The sides of all of the cars are of No. 15 gage sheets having six ribbed sections running the full car length. The formed sections of the framing structure were assembled and welded together on a hydromatic spot welder. The steel ends have reinforced corner posts and the lightweight Z-26 center sills are of special steel composition. Additional Z-pressing supports give added strength to the floor. Lightweight cast-steel striking castings and bolster center fillers are attached to the

Flexible steel straps hold the upper deck load securely in place

Principal Dimensions and Weights of New Milwaukee 50-Ton Box Cars

Inside length	40 ft. 6 in.
Inside width	9 ft. 2 in.
Inside height at eaves	10 ft. 6 in.
Inside height at center	10 ft. 11¼ in.
Width of side door opening	6 ft.
Length over striking casting	41 ft. 7⅝ in.
Length between truck centers	30 ft. 7⅝ in.
Cubical capacity	3,898 cu. ft.
Weight capacity nominal	100,000 lb.
Light weight	42,600 lb.
Load limit	126,400 lb.
Ratio of load limit to gross load	74.8 per cent
Ratio of light weight to cubic capacity	10.93 lb. per cu. ft.



General arrangement of one of the new Milwaukee 50-ton box cars

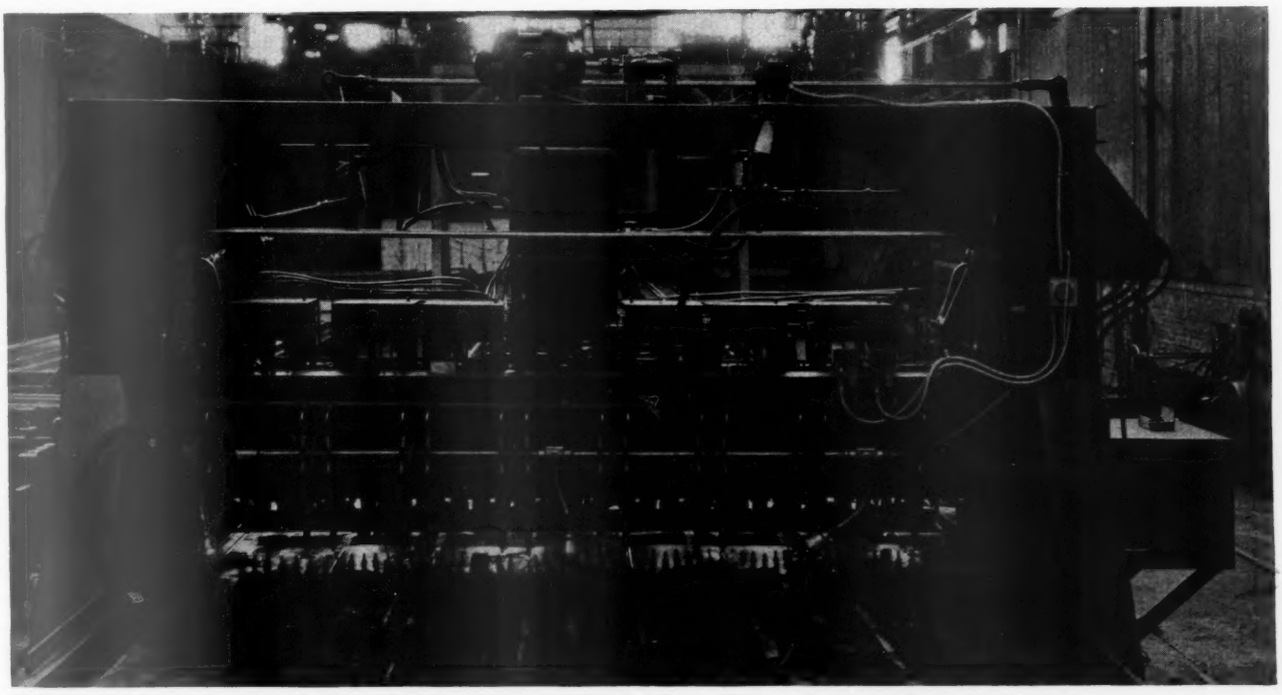
center sill by welding. The ceilings are of Douglas fir plywood. The side and end lining, also of Douglas fir tongue-and-groove lumber, is arranged with clean-out boards which can be taken out to remove grain, etc., which may find its way behind the lining.

The cars are equipped with Barber stabilized trucks and AB brakes.

Cars for Double-Deck Loading

The combination double-deck anchoring device in 25 of the cars has been installed to meet the growing demand for a more flexible means of handling various commodities and mixed loads. Although attempts in this direction have been made by several railroads it appears that the developments were such that the various cars became specialized units, adaptable only to certain types of lading. In addition to the double-deck feature, means are available for anchoring lading without nailing wooden braces to the sides or floor of the car.

The principal new features of these 25 cars include the application of 144 metal anchor pockets to the interior side walls, which can be used for anchorage of cross beams when double- or even triple-deck loading is used. These pockets are located at six elevations and at 12 intervals on either side of the inside walls of the car. When the supports are in place across the inside of the car, grain doors or other flooring is laid thereon to provide a second or third deck, as needed. These are held in place by nails through the wood centers of the steel cross beams. When the cross beams are not in use, they are carried in a receptacle underneath the car, and to protect them from being stolen a seal pin and seal is applied. The anchor pockets, which have a flat upright key pin welded in each pocket, can also be used to hold



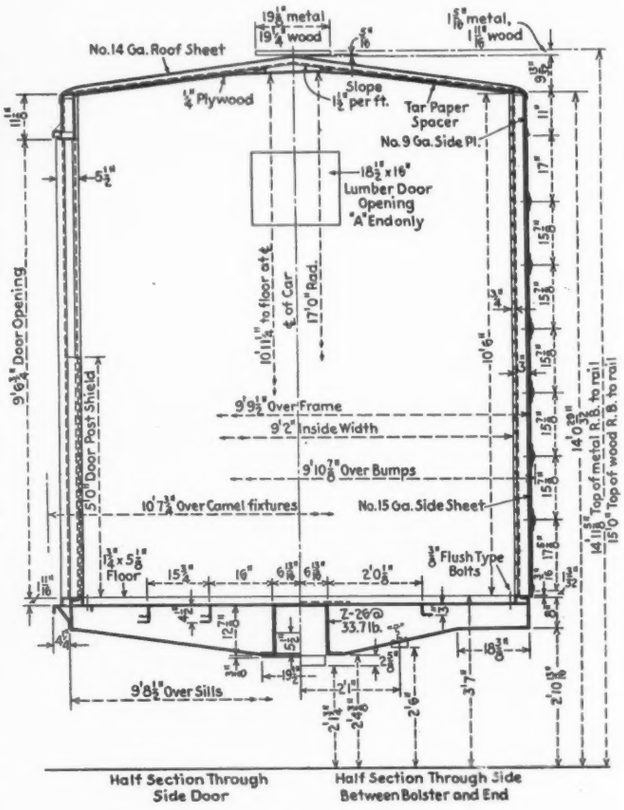
Hydromatic spot-welding machine used in Milwaukee, Wis., shops to fabricate the car sides at the C. M. St. P. & P.

Special steel floor plates can be seen at the doorway—The lift truck is used in applying double-deck load

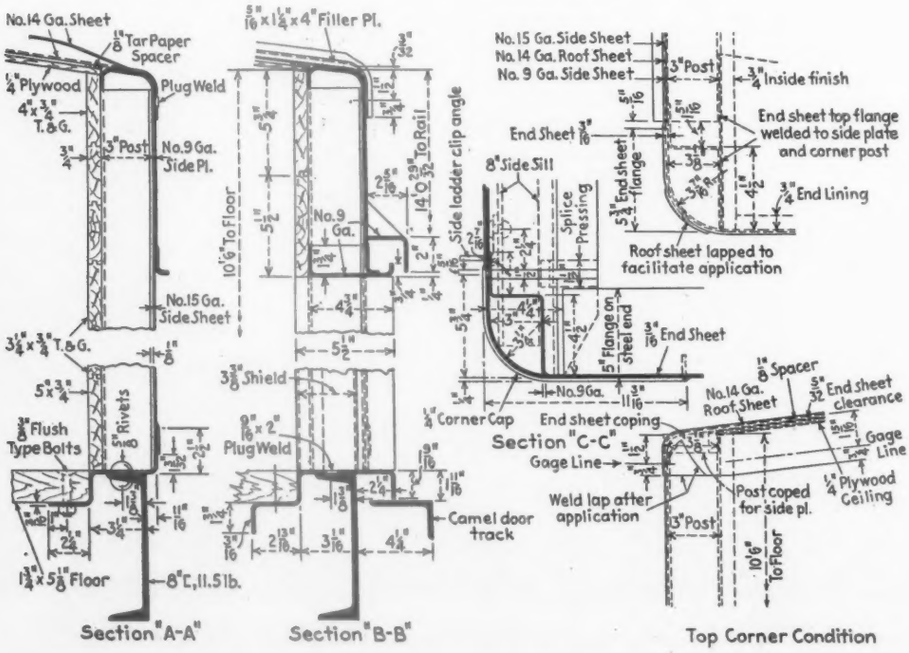
flexible steel straps. When drawn taut with a mechanical ratchet device these straps prevent shifting of the lading, and eliminate the wooden cleats or blocking now generally used. The straps may also be used instead of lumber as door protection. The design of the metal pockets provides a flush interior and does not interfere with present standard loading methods for bulk or package commodities.

This double-deck loading design lends itself more readily to split or mixed l. c. l. loads and the loading of like commodities when high piling might crush the lower tiers; and cost and time are saved in anchoring the load due to the use of the metal banding. Where the rates for tractor loadings for eastern and southern territories are the same regardless of the size of car used or the weight of load therein, it has been demonstrated that by double decking the loads, the 40-ft. car will carry an ordinary 50-ft. car load. Therefore, as the lighter 40-ft. car is less costly to build and maintain, it should prove more adaptable to general transportation requirements.

The method of anchoring the loads with metal straps also tends to prevent damage to both the floor and the side lining, which constitute the most important single elements of car-repair cost. The new construction therefore is well adapted to make a substantial reduction in car maintenance expense. The principal objective, however, is to provide improved service and hence attract new business to the rails.


No.14 Ga. Roof Sheet
Slope 1½" per ft.
Tar Paper Spacer
No. 9 Ga. Side Pl.
Lumber Door Opening "A" End only
Door Post Shield
9'9½" Over Frame
9'2" Inside Width
9'10⅞" Over Bumps
10'7¾" Over Camel fixtures
No.15 Ga. Side Sheet
Flush Type Bolts
Z-26 @ 33.7 lb.
9'8½" Over Sills
Half Section Through Side Door
Half Section Through Side Between Bolster and End

Half-sections through a Milwaukee 50-ton box car



Roof and corner sections of a Milwaukee 50-ton box car

Factors Influencing the

Service of Firebox Materials*

By Ray McBrian†

Aging properties, surface strength and the effect of temperature considered — Use of alloying elements, particularly molybdenum, to improve characteristics of firebox materials discussed

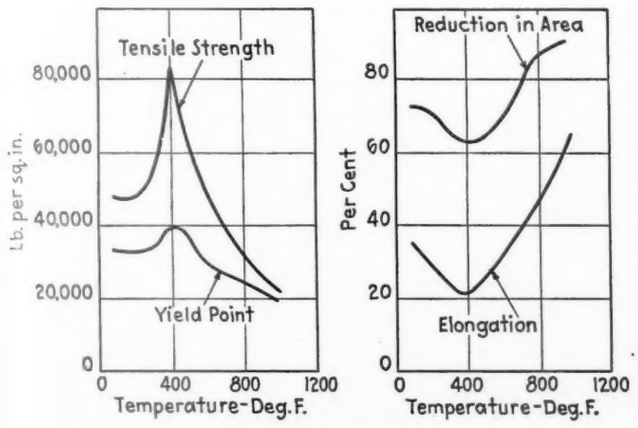
WE have been challenged to seek improvements in the steam locomotive or to face the possibility of seeing it replaced by other types of motive power. I hope, by this paper, to point out some difficulties encountered and outline possible improvements which may be made in our present type of firebox materials.

The important factors which have not been fully understood, or readily recognized, as affecting the service life of firebox materials may be classed as follows: (1) Effect of temperature, (2) surface strength and (3) aging properties. These will be discussed in detail, but may I first suggest a comparison between the effects of service upon firebox materials and the effects of time upon ourselves. Similarly, as we age with the passing years and develop such weaknesses as stiffening of the joints, hardening of the arteries, etc., so do our firebox materials react to the effects of service environment. A good many of you, who are beginning to work with higher boiler pressures, are possibly having troubles which you did not experience before and are aware that these problems do arise from service.

Since you are familiar with constructional and design problems, this paper will be confined to a discussion of the problems relating to the materials used in the firebox which is subjected to the severest operating conditions.

Effect of Temperature on Firebox Materials

All of us recall that our specifications for firebox, boiler, and staybolt materials are based upon the properties of the material, determined by tests made at room temperature. We also know that the severest service imposed on these materials occurs at elevated temperatures. Many of you realize, I am sure, that the properties of these materials at service temperatures differ greatly from those properties we determined at room temperature, and that we should have based our specifications upon actual operating temperatures. To demonstrate, Fig. 1 shows the physical properties of A. A. R. plain carbon rimmed steel. It will be noted that the physical properties change with an increase in temperature. At 400 deg. F., for instance, the tensile or ultimate strength is almost double the room-temperature value, and, at 1,000 deg. F., it is practically half the room-temperature value. Similarly, there are changes in the values for the yield point, elongation and reduction of area.



CHEMICAL COMPOSITION

Carbon, per cent	0.11
Manganese, per cent	0.41
Phosphorus, per cent	0.010
Sulphur, per cent	0.028
Silica, per cent	0.008

Fig. 1—Change of physical properties of a typical rimmed steel with an increase in temperature.

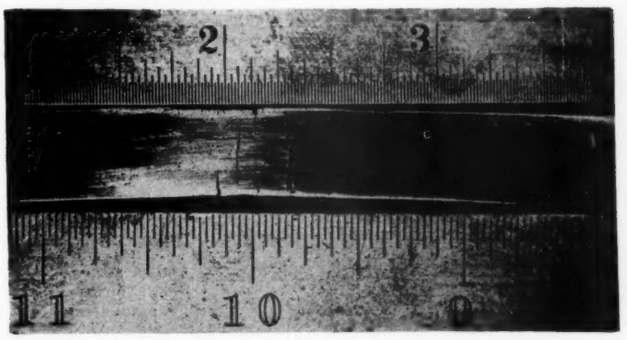


Fig. 2—This piece of firebox steel met room-temperature specifications when applied. In service it has been deformed permanently.

Let us examine, for a moment, the temperature range 300-600 deg. F. These temperatures are commonly associated with the "blue brittle" range. This brittling phenomenon is also observed in the case of firebox steel, which, at 400 deg. F., has a marked elevation of tensile strength and yield point, coincident with a lowering of the elongation and reduction of area. Compared with the room temperature values, these properties at 400 deg. F., indicate brittleness. Because of its importance, I call attention to the peaks shown on this diagram. These peaks, which show a sharp rise in tensile strength, do not necessarily mean that because the tensile strength is higher the steel is better, but, on the contrary, they indicate a very pronounced aging tendency.

This discussion may seem somewhat technical, but let us examine its effect from the practical standpoint. In other words, let us translate this diagram into practical terms. Fig. 2 shows a piece of firebox steel which passed the room-temperature specifications, yet in service we

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* Paper presented at a session of the Master Boiler Makers' Association annual meeting, October 23, 1940, at the Hotel Sherman, Chicago. The data collected and the conclusions presented in this paper have been the result of a co-operative research program of the National Aluminate Corporation and the Denver & Rio Grande Western.

† Engineer of tests, Denver & Rio Grande Western.

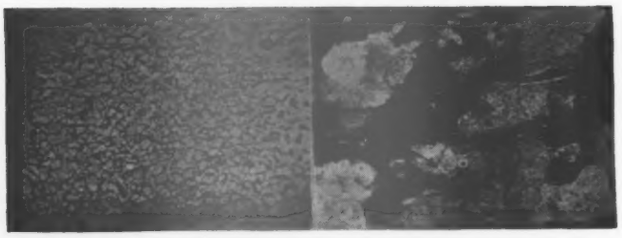

Fig. 3—Left: Normal structure of A. A. R. firebox-grade low-carbon steel. Right: Grain growth and incipient fusion at grain boundaries of burned firebox steel. (Magnification: Left, 100; Right, 250.)

see that the plate has been permanently deformed. This deformation can occur in only one way. The elastic limit must have been exceeded; not the elastic limit at room temperature, but the elastic limit the steel possessed when it was deformed. For example, as shown in Fig. 1, at 1,000 deg. F., the stress necessary to produce such a deformation may be only half the value necessary at room temperature.

The question naturally arises as to the effect of some insulating medium such as scale in raising the temperature, but I would like to stress the need of recognizing the actual operating temperatures, as we have had the opportunity to examine permanent deformations or corrugations which occurred very soon after the locomotive was built and put into service. Examination of these corrugated sheets failed to reveal any cause for deformation other than stress-temperature conditions prevailing in

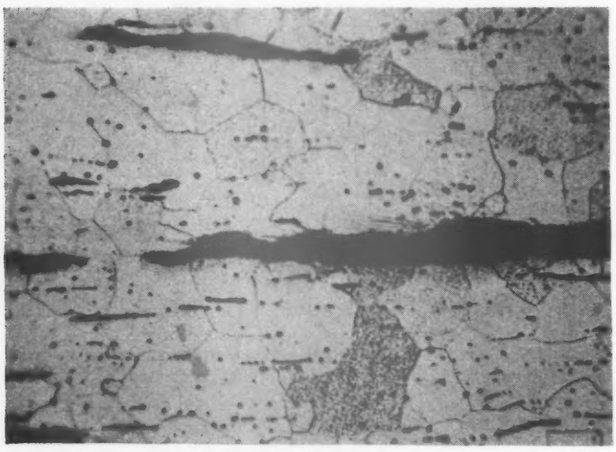

Fig. 4—Typical structure of a wrought iron staybolt. (Magnification of micrograph, 250.)

service. Elevated temperature tests also revealed that the material had too low an elastic limit at the operating temperature.

Many times the question has arisen as to whether or not a piece of firebox steel has been burned. Fig. 3 may be of interest to you in that it shows how this condition may be detected and recognized. The micrograph at the left shows the structure of normal low-carbon steel (A.A.R. firebox grade) while the one at the right shows the tremendous grain growth and incipient fusion at the grain boundaries associated with the burning of the same type of material.

We have observed the effect of temperatures as high as 1,000 deg. F. in the head of an iron staybolt. To illustrate, Fig. 4 shows the typical structure of a wrought-iron staybolt. Fig. 5 shows the microstructure of an iron staybolt that had been in service for some years. The coarse grains of this structure were reproduced by recrystallization after cold work. Since the lowest temperature of recrystallization is around 1,000 deg. F., we know that the head of this staybolt had been subjected to this temperature; otherwise, the iron would not have recrystallized. This is of importance because it shows that some of our materials of construction have high surface temperatures. These temperatures vary throughout the material and result in temperature-stress gradients.

Since we have mentioned iron staybolts, the question

Fig. 5—Microstructure of an iron staybolt after some years of service. (Magnification, 1,000.)

probably arises, do the changes in physical properties at elevated temperatures apply to iron as well as to low-carbon steel. Fig. 6 shows the effect of temperature on the physical properties of double refined staybolt iron. It is of importance to note the changes in the physical properties at 400 deg. F., where there is an increase in tensile strength and a decrease in ductility. Also note the low tensile properties at 1,000 deg. F. We have made tests on a large number of the standard staybolt irons and have one instance on record where, at 1,000 deg. F., the staybolt had practically no tensile strength. The effect of the use of such materials, with their very low physical properties at operating temperatures, is the occurrence of such service failures as pulled bolts and possibly leaks.

Surface Strength

I am reminded of an old axiom, a chain is as strong as its weakest link. The center of a steel plate is the link

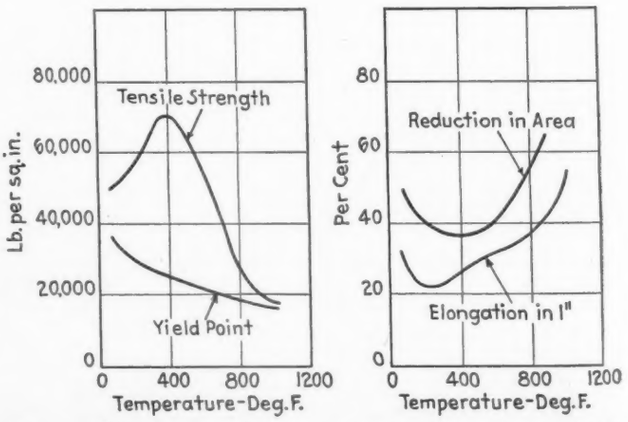

Fig. 6—Effect of temperature on the physical properties of double refined staybolt iron.

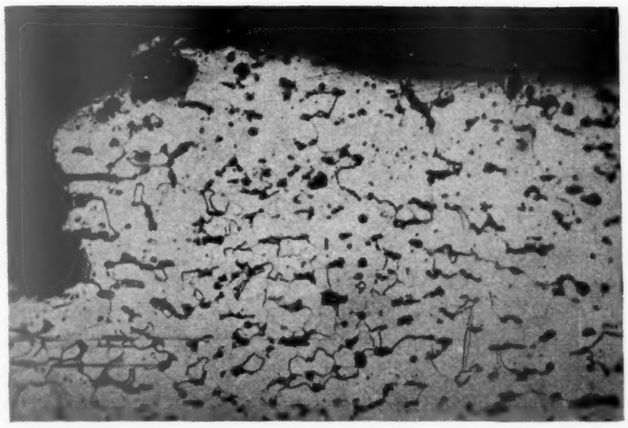

Fig. 7—Photomicrograph at the surface of a section of A. A. R. firebox steel. A depletion of the carbon at the surface is indicated by the decrease in dark areas at the top. (Magnification, 100.)

which connects the two surfaces, and, if the surface of the plate were as strong as the center, we would have a strong chain from edge to edge. But, unfortunately for us, this is not the case. All constructional steels fabricated in the hot rolled condition have decarburized surfaces. This decarburized surface, as you may know, is produced by the oxidation and diffusion of carbon out of the steel at its surface and may vary from a few thousandths to somewhat over one-hundredth of an inch. Obviously, the strength of the plate is less at the surface than at the center. Yet we have failed to recognize and take into consideration this condition. Fig. 7 is a photomicrograph at the surface of a section of standard A.A.R. firebox steel, showing a depletion of carbon at the surface, as shown by the decrease in the number of the dark areas which contain the carbon, and an increase in the light or ferritic areas. Although the average physical properties of the cross section may be within the specification requirements, as measured by the tensile test, it is to be noted that the decarburized layer at the surface may have only one-half the strength of the interior. Remember, also, that the physical properties for both the interior and surface change with temperature, and it is at the surface where the highest temperature is obtained that maximum stresses can occur. It is also at the surface where fatigue cracks originate and, as an example of what may occur in service, Figs. 8, 9 and 10 show surface fatigue cracks which occurred because of insufficient surface strength. This material, as purchased, met the A.A.R. specifications, yet failed after only eight months of service. Fig. 8 shows the fire-side surface of the plate, as received for examination. Fig. 9 shows this same surface after having been Magnafluxed. You will note the outline by the Magnaflux powder of the fatigue cracks. Fig. 10 shows this same surface after a portion of it had been ground. It is noted that, even after grinding the cracks prevail, showing that they had progressed to considerable depth.

Steel staybolts are subject to surface weakness, due to surface decarburization, which may be the cause of failure, as shown in the next two illustrations. Fig. 11 is a photomicrograph, showing decarburization at the surface and a small crack. Fig. 12 shows a section of the failed bolt. It is important to call attention to the fact that steel staybolts may be subjected to aging.

Service Aging

Aging is a spontaneous change of physical properties with the passage of time. This change is accelerated by the application of stress and an increase in temperature, and manifests itself in boiler and firebox steels by a raising of the yield and ultimate strength, accompanied by a corresponding loss in ductility. In the case of firebox and boiler steel, this aging is accelerated by cyclic stresses.

A stress cycle occurs each time the locomotive is fired up. Washing, and repeated heatings and coolings occasioned by feed water intermittently passing over the hot metal, introduce stresses, as do the opening and closing of the throttle while the engine is working. Table 1 shows the effect of boiler washing on the aging of firebox steel, which is shown by an increase in the yield point. It will

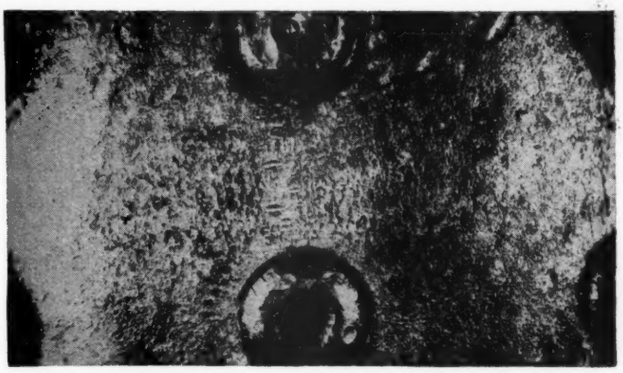

Fig. 8—Fire-side surface of a piece of firebox plate that developed fatigue cracks because of insufficient surface strength.

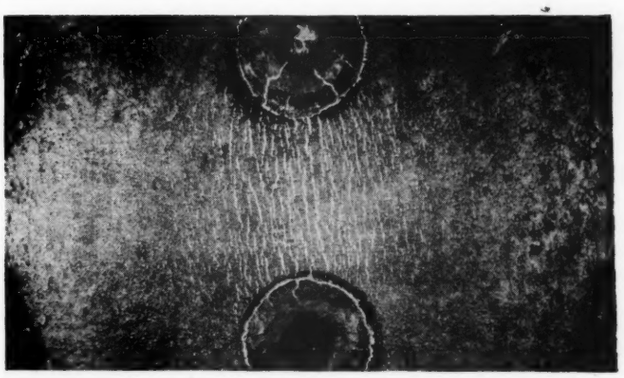

Fig. 9—The same surface shown in Fig. 8 after having been Magnafluxed. This plate failed after only eight months of service.

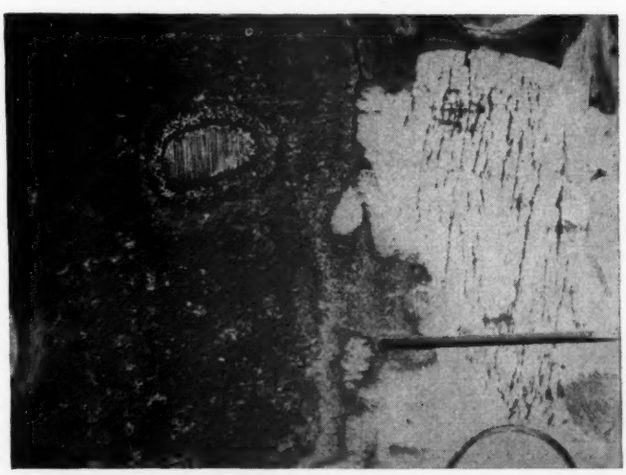

Fig. 10—The surface shown in Figs. 8 and 9 after a portion of it had been ground showing the cracks had progressed to a considerable depth.

Fig. 11—Photomicrograph showing surface decarburization and a small crack in the surface of a steel staybolt that failed. (Magnification, 100)

be noted that the least aging occurred on sheets in locomotives operating on a 30-day washout schedule.

The effect of aging has also been investigated by the application of X-Ray diffraction. In this method, the amount of strain is determined from the atomic displacement in the lattice. An example of this method of checking aging, Fig. 13, shows the diffraction of a piece of firebox steel which has not been aged. The diffraction patterns were made on the surface of the fire side, the center of the material, and the surface of the water side. This material, when removed from service, had a yield point of 35,000 lb. per sq. in. The three bottom photographs are patterns of a severely aged specimen which had a yield point of 49,360 lbs. per sq. in. and an ultimate strength of 59,150 lbs. per sq. in. Without going into details, I have shown this as a new method of analysis. It will be noted that the material is not strained or aged uniformly from surface to center.

Table II gives the results of physical tests of some firebox plate removed from service on an eastern locomotive. This was rimmed steel and, as shown in Fig. 1, rimmed steel has elevated temperature characteristics of very pronounced peaks in the blue-brittle range. The peaks indicate that this type of material would age, and, from this service test, it can be seen that aging had been severe.

Table I—Effect of Boiler Washing on the Aging of Firebox Steel

Location	Years of service	Yield point, lb. per sq. in.	Ultimate strength, lb. per sq. in.
Average of 30 days between boiler washouts.			
Side sheet	15	34,100	61,700
Side sheet	7	35,100	61,900
Crown sheet	20	44,100	59,620
Back head	17	42,970	66,800
Door sheet	16	38,920	55,620
Crown sheet	16	48,870	64,120
Side sheet	16	43,280	59,200
Side sheet	16	43,400	60,980
Average of 15 to 20 days between boiler washouts.			
Door sheet	6	41,300	60,250
Side sheet	7	35,100	61,900
Side sheet	12	46,600	61,000
Crown sheet	21	41,200	55,750
Side sheet	19	48,400	65,200
Side sheet	16	45,450	66,900
Average of 2 to 5 days between boiler washouts.			
Door sheet	11	51,400	57,620
Side sheet	10	47,100	61,000
Crown sheet	9	48,200	58,840
Crown sheet	9	55,900	68,340
Side sheet	10	51,390	57,180
Side sheet	10	51,250	60,000

Table II—Physical Tests, Firebox Plate

	As rolled	As removed from service
Yield point, lb. per sq. in.	36,000	60,200
Ultimate, lb. per sq. in.	57,400	66,200
Elongation, per cent	33.0	25.0
Reduction of area, per cent	61.0	56.5

Fig. 14 will be of interest in that it shows a specimen cut from a crown sheet which had aged in service. It will be seen that the specimen exhibits a double necking phenomenon. These necks occurred adjacent to staybolts. In connection with the aging problem, there are, of course, other influences which should be briefly mentioned. One is the effect of the design which permits stresses to be localized. Another is the effect of the plac-

Fig. 12—A section of the steel staybolt, the surface of which is shown in Fig. 11.

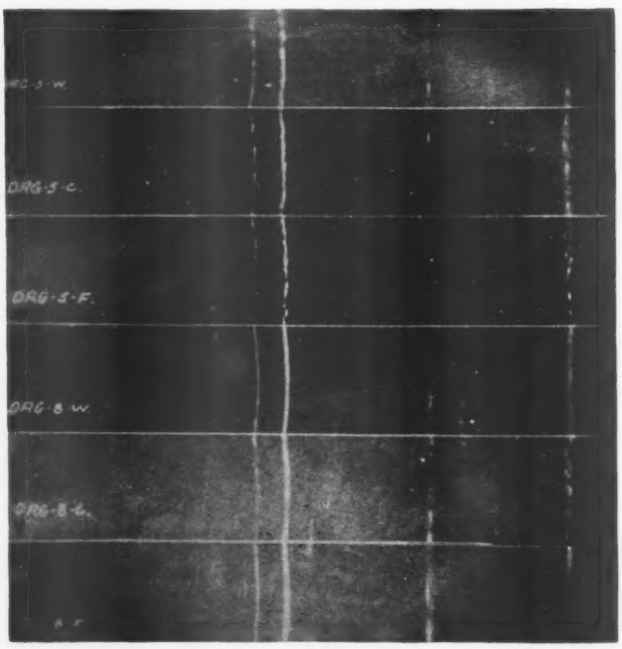

Fig. 13—Diffraction patterns made on the fire-side surface, center and water-side surface of a piece of firebox steel. The top three patterns are of a specimen that has not been aged, the bottom three are of one severely aged.

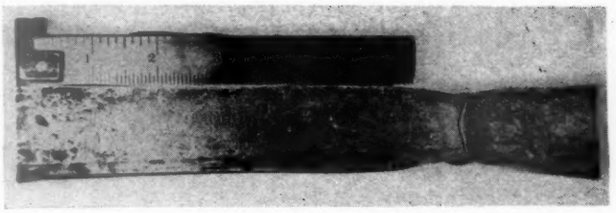

Fig. 14—This specimen cut from a crown sheet, aged in service, exhibits a double-necking phenomenon.

ing of low-carbon and high-carbon sheets in the same firebox. By low and high carbon, I mean carbon in the lower range and higher range of our present specification. An actual example is one where we found that, where a 20 carbon material was used in the crown sheet, and a 14 carbon in the side sheet, the crown sheet aged in service. This, of course, suggests a question for consideration, and that is, do we permit too wide a carbon range in our specifications?

Molybdenum Improves Physical Properties

We have discussed three important factors which affect the service life of our firebox material. Now let us consider the possible approaches toward a solution of the problem. Of course, the obvious solution would be to provide a non-aging, uniform material, the strength of which under all operating conditions would be greater than the maximum stress that would be imposed upon it. This is rather a simplified expression, but probably the reason such a material has not yet been provided is because of the failure to recognize the full importance of these factors which have been under discussion.

Considering the elevated temperature effect, it will be necessary to select a material which not only has sufficient strength at elevated temperatures, but also one with physical properties as uniform as possible over the range of temperature occurring in service. Some satisfactory indications have been obtained from research studies by using alloy steels and from the making of alloy wrought iron. For example, a comparison of Figs. 15 and 16 will show the effect of the addition of molybdenum. Fig. 15 gives the physical properties of standard firebox steel. Fig. 16 gives the properties of a carbon-molybdenum steel. The addition of molybdenum has increased very materially the yield strength as well as the ultimate strength. Also, the ductility is greater for the molybdenum steel. This is one example of the benefits that may be obtained by the addition of alloying elements.

Molybdenum has also been added to staybolt iron to make an alloy, and Fig. 17 gives the physical properties of this material at elevated temperatures. Comparing this with the properties of the standard staybolt iron which are shown in Fig. 6, it will be noted that the properties at elevated temperatures have been improved. Of special importance is the maintaining of higher yield strengths at the higher temperatures in this alloy iron.

Our designers and writers of specifications should take into consideration the physical properties at elevated temperatures of the materials to be used. Probably alloy steels and alloy irons will be a necessary requirement. The use of an alloying element such as molybdenum in both iron and steel will thus aid in preventing deformations occurring from lack of physical strength under operating conditions. It will aid in preventing leaks at the higher pressures and temperatures by allowing a material to be used which has greater yield strengths and which is capable of maintaining loads at larger elastic strains.

Considering now the factor of surface strength, it has been shown that the rolled surface may be seriously weakened by the presence of a decarburized layer. Present manufacturing methods, however, seem to offer little promise for the elimination of this decarburization, but, until we are able to purchase steel free of decarburization we must look for some other means to eliminate surface weakness. If it is not practical to remove it, what can be done to strengthen it? Again we find the use of alloys suggested, and molybdenum again is beneficial. This element enters into a solution with the iron or ferritic surface and gives it added strength. Although the carbon may be depleted from the surface of a molybde-

(*Continued on page 540*)

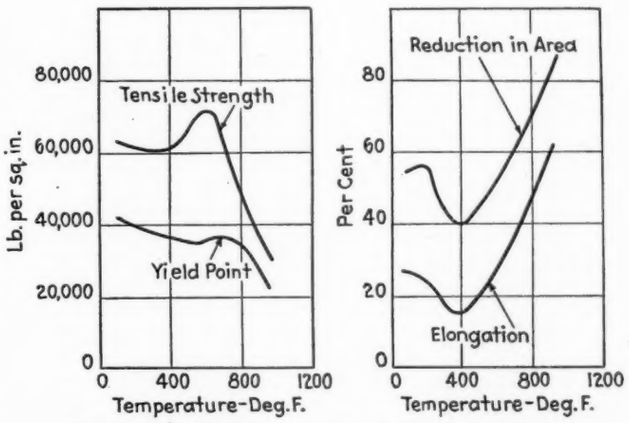

Fig. 15—Physical properties of standard firebox steel.

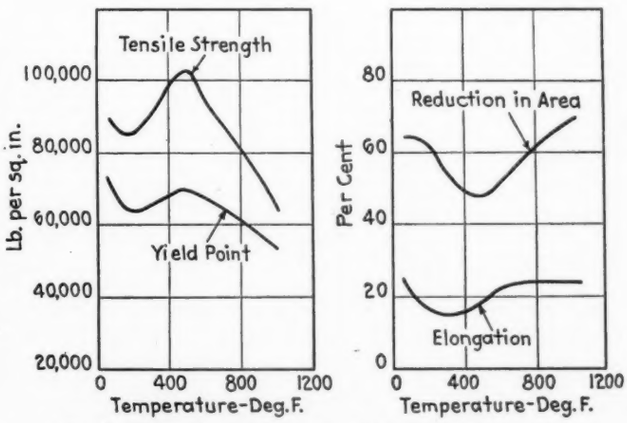

Fig. 16—Physical properties of a carbon-molybdenum steel.

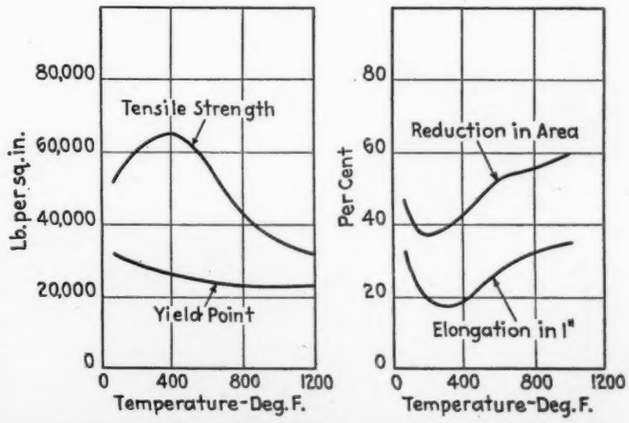

Fig. 17—Physical properties of staybolt iron to which molybdenum has been added. Compare with physical properties shown in Fig. 6.

Two Jobs

For Every Railroad Man*

Col. R. S. Henry

By Robert S. Henry†

Weak spot in railroad case is that public (your neighbors) does not understand the real facts

WE in the railroad business get lectured quite a bit from various sources, to the effect that we should learn how to co-ordinate. There is a thought in some quarters, at least, that railroad men are by nature so rabidly individualistic that they can't get together to accomplish a common end. Yet to anyone who really knows what to look at, the railroad business offers the greatest demonstration known in the business world of effective, everyday, all-inclusive working co-ordination of effort.

The most remarkable fact about commerce on this North American continent is the fact that any one anywhere can pick up a telephone and ask for a freight car to be placed at his dock or track for loading, that he can load that car to go anywhere else on this continent, or even to Cuba, and turn it over to a railroad, and never think about it again until, in due course, it is delivered at the other end. Nowhere else on earth, and in no other business in the United States, is there such a high degree of practical, everyday operating co-ordination as is demonstrated by this simple fact which has existed so long that all take it for granted, and think no more about it.

I sometimes wonder if that isn't one of our difficulties in the railroad business. We, ourselves—as well as the people whom we serve, and whose lives depend upon our service—have come to take our service too much for granted. We have ceased to recognize the enormous number of skills that are required to do these things. We have ceased to recognize the high degree of managerial adjustment, the high degree of co-ordinating ability that it requires to have something more than a million men in the three great nations which occupy this North American continent, all working to do the seemingly simple but actually very complex job of taking a carload of freight from anywhere on this continent to anywhere else, and doing it every day in the year, doing it regardless of mountains, regardless of rivers, regardless of snow or ice, regardless of heat or drought, doing it all seasons and in all weathers, and doing it so cheaply that the average revenue for hauling a ton of freight a mile on the railroads of North America is only a little less than one cent.

Perhaps we haven't impressed upon the public enough the tremendous job that the railroads and railroad men are doing for the rest of the people of this continent every day in the year.

Every Railroad Man Has Two Jobs!

There are somewhat more than a million railroad men in North America. Every one of them has two jobs, whether he knows it or not. He has the job that he was specifically hired to do, some one of the 128 major classifications of jobs, according to the Interstate Commerce Commission and in addition to his regular job, he has another. *He is an ambassador, a representative of his industry to the public whom we serve, the public upon whose support and patronage we depend and by which we exist.*

Every railroad man is a public relations man, whether he knows it or not. He may be, as most of them are, a good public relations man, or he may be, as some few of them unhappily are, a bad public relations man, but a public relations man of some sort he is. Everything he does every day, in the carrying out of his duties and in his dealings with the public, and in his personal contacts when off duty, with his friends and neighbors, everything he does every day affects the regard, the esteem, the understanding, the appreciation that the people of this continent have for the railroad industry. It affects not only what they think about us, but what is far more important, how they feel about us.

For some curious reason the people of the United States look upon the railroads not as separate companies doing separate jobs. *They look on us as some sort of an entity*—"the railroads"—and they either like us or don't like us. So a second part of every railroad man's job, in addition to the specific duties he is hired to perform, is *the way he does his other duty, the way he acquits his other responsibility of being an ambassador to the public.*

It is up to us to know the story of railroads, to know what they are, to know what they do, to know what they mean in this country. It is up to us not only to know the story, but to tell it, because upon public understanding

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* Address at the joint opening session of the annual meetings of the Railway Fuel and Traveling Engineers' Association, Car Department Officers' Association, Master Boiler Makers' Association and Locomotive Maintenance Officers' Association, held at Chicago, October 22, 1940.

† Assistant to the president, Association of American Railroads.

and public appreciation of the facts about railroad transportation depends, in the long run, not only the financial success or failure of the companies for which we work, but also the payroll, the pay envelope, the pay check of every man who works for the railroads.

The Railroad Story

Now what is this railroad story that we need to know and tell? I hardly need to go over it in any detail, but I do want to hit one or two of the highlights, one or two of the things common to all railroads in the United States.

There is one thing that everybody knows about—for the last ten years, at least, we haven't made as much money as we should have made to keep our credit good and to maintain our ability to continue to make improvements up to the level that we would like to have. Thirty-one per cent of the railroad mileage of the United States is in the hands of the courts in one form of bankruptcy or another, and there is a school of thought in this country (happily declining in importance and influence, I think) which believes that the cure for the so-called railroad problem is—but let me go back a bit.

We talk about the railroad problem now. There has always been a railroad problem. *A little more than a hundred years ago, the problem was whether you could get trains to run on tracks or not.* That was solved. *The next problem was to get railroads in this country.* The country had to have them; the country was crying for them; people everywhere demanded railroads. The problem was to find the money. In a few decades this country was spanned with a network of rails, and that problem was solved.

Our next problem was to increase the operating efficiency and improve the service of the railroads. We had to make better roads, more efficient roads, roads which could produce more service at lower cost, roads which could sell their services for less and pay their men more.

Sixty or seventy years ago, the average revenue for hauling a ton of freight one mile was more than 3 cents. In those days, $2 a day represented good wages. Most railroad men worked for a dollar a day or thereabouts, and many of them worked for less than that. You could hardly find taxes, as compared with present taxes.

Now we haul a ton of freight a mile for 1 cent—a little less than one-third of what we received for doing the same job sixty or seventy years ago. Wages have vastly improved, as they should have. Taxes have multiplied, as they have to do, and yet somehow we are doing the job for 1 cent and meeting these other costs as they come along.

That didn't just happen. We are not better railroad men than the men back in those days were, individually, man for man. The difference lies in the tools we work with, the plant we use, the investment which has been made to make it possible to do the job better and more cheaply. Because we have got the kind of railroads we have now, we are able to do the things we do now.

So that railroad problem was solved. Not perfectly. The solution still goes on. I hope we never have to stop doing the job better with better tools and better methods.

The Earnings Problem Not Solved

But there is one railroad problem we have not yet been able to solve, and that is the earnings problem. For the last 20 years—since the World War—this country has seen a great boom and a great depression. When the boom was on, the theory of those who controlled public policy dealing with railroads was that railroads, forming a regulated industry, should not be allowed to make too much money.

Our prices didn't go up in the boom. We didn't enjoy the boom period as others enjoyed it. We ran along pretty well on an even keel, devoting a large part of our earnings in that period to the necessary rehabilitation and improvement of the railroads made necessary by the results and experiences of the World War. Those were the years in which we modernized these railroads, but we didn't let people know about it.

There is nothing much more modern than our railroads now. I don't mean that everything about them is modern, of course, but the big modernizing job, the fundamental job—the capacity we have built into our tracks, terminals, bridges and signals, improvements in our power and cars—is pretty well carried forward, so that it cannot be said that our present financial difficulties are due to any deterioration of service. Service today is far better than it was in the years when railroads were more prosperous. Our trains are running faster; they are producing more ton-miles per train-hour. They are doing the work more efficiently, far more dependably than they were at the close of the World War and the years just after that.

It cannot be said that our difficulties of this period are due to raising our rates so high that we have discouraged our business, because our rates, on the whole, have been declining since the years when we were more prosperous. Our passenger rates today are the lowest they have been in the history of railroading. Our freight rates are approximately one-fourth less than they were just at the close of the World War period.

Fallacy of "Wringer" Prescription

Neither can be it said that our difficulties are due to an increase in the burden of capitalization or debt—even though one of the popular prescriptions for curing whatever is wrong with the railroads is the so-called "put them through the wringer" prescription.

The thing we shall put through the wringer, if we adopt the "wringer" prescription, is the hopes and just expectations of the people who put up their money and savings to build and improve these railroads. Our investors are not big, rich people. There is not much "rich" money in the railroad business—it is small investors' money, life insurance money, savings bank money. We have nearly a million bondholders, 65,000,000 life insurance policyholders, 30,000,000 savings bank depositors, and nearly a million stockholders interested in railroads. They are small holdings on the whole. These people have put up much of their money on securities the issuance of which was approved by public authority. They put it up with the fair expectation and the just right to receive a return on it, if we could earn it. In many cases we haven't been able to earn it. That is the real problem of the railroad business, not the physical problems. Those have been measurably well solved, and the solution is improving from day to day and from year to year. The big problem is how we are going to earn what these people are entitled to, these people who provide the tools with which we work, and *that* problem is not going to be solved by a wholesale, unnecessary repudiation of our obligations.

There are times when any business may have to go through the wringer, and there are processes provided for that sort of thing—processes of bankruptcy in the courts—and I might say right here that railroads, although 31 per cent of the mileage is in one form or another of bankruptcy, have no monopoly on going broke. Others go broke too, and machinery is provided by the law to meet such situations when they arise.

But to force railroads as a class to reduce their capital obligations unnecessarily, is simply deferred confiscation of the money that people—just ordinary people like us—put into them.

Capitalization Not Excessive

Excessive capitalization is not the cause of railroad financial difficulties. Thirty years ago, when railroads were relatively prosperous, the total capitalization for each $1000 invested in railroad plants and equipment amounted to $987. That is, all the stocks, bonds, equipment trust certificates and every other form of outstanding capital obligation amounted to $987 out of each $1000 invested. Last year the total capitalization of the railroads amounted to $715 for each $1000 invested. All the stocks, all bonds, all equipment trust certificates, all of everything else, amounted to only $715 for each $1000 invested.

Thirty years ago our debt on bonds amounted to $606 for each $1000 invested. We were in the position then of a man with a house in which he had invested $10,000, and on which he had a mortgage for $6060. Last year our bonds amounted to $420 per thousand dollars invested. We are now in the position of a man with a house in which he had invested $10,000, and on which he had a mortgage of $4200.

During the years in which our relative prosperity (as compared to the rest of the country) has declined, our burden of debt has been growing smaller, so that whatever may be the cause of our trouble, it certainly isn't growing debt.

But it is perfectly obvious that there is some cause of railroad financial disability. What is it? It lies in one fact—the public policies applied to transportation in this country throughout the past generation or two. Notice I said "policies," because we have two, and they are just as distinct as they can be. They are perfectly contradictory, or have been up until the very recent past.

To the railroads public policies say "You shall be self-supporting. You shall provide your own ways, your own tools and equipment, your own investment of all sorts. Then having done that, you shall pay all your own expenses. In addition to that, you shall pay taxes; real taxes, not money earmarked to be spent on railroad tracks but money that goes to keep up schools and public institutions in the general operations of government."

Taxes and Subsidized Competition

The taxes of the railroad industry are a very serious item. I don't mean to say that we are overtaxed, as compared with other industries. I don't know—you could get up an argument about that, I presume—but it is a fact that whereas 30 years ago we were paying about 2 or 3 cents out of each dollar of revenue for taxes, last year we paid just under 10 cents on each dollar of revenue received for taxes.

Taxes, you know, come out first. With that position we can have no proper quarrel. Every business ought to be self-supporting, if it is economically justified. Every business ought to help support government. Somebody has to support it, and in the long run, the earnings to support government have got to come out of business.

But when we come to most of the other kinds of transportation in this country, we reverse that practice and the money comes out of the government to help support transportation. That makes a difference. I shall not go into it at great length here, but let me take one example—the waterways. We talk about "cheap water transportation" in this country. In fact, we have talked about it so much that we have run the three words all together—"cheapwaterwaytransportation"—as if it were all one word.

Now there *is* cheap water transportation, and there is water transportation so fantastically expensive that only a rich and prodigal government like that of the United States could dream of providing and supporting it. I'm not going to take the horrible examples; let's take the best. Let's take the Ohio river, the best of the long distance inland improved river transportation systems in the United States.

The Ohio river isn't a natural stream. For commercial purposes we have had to build a river, and it has cost us a lot of money. I am not going to give you the gross figures, because gross figures don't do me or anyone any good. We have all become so used to thinking in terms of billions and hundreds of millions that the sound has ceased to affect us. In fact, there is a certain large, mouth-filling, soul-satisfying sound about a hundred million dollars. (Laughter.)

So let's not take these hundreds of millions and talk about them; let us cut them down to size. To build the Ohio river has cost the taxpayers of the United States $143,000 a mile. That mile is measured not on any straight-line distance or short line rail distance, but as the river winds. To convert that into equivalent rail miles, add about a third. So to build that river—and that is what we have done, built a river—has cost a little more than $200,000 a mile.

Now by way of comparison, look at the railroads. The railroad lines—roadway and bridges alone—of the United States cost $62,000 a mile to build, so that your river is three and one-half times as expensive per mile to build as a railroad line. To maintain that river costs about $4800 a mile on the average, measured as the river winds. Reduce that to an equivalent rail distance, and you will add another $1500, and you get your total up over $6000 per mile, which again is about three and one-half times what it costs to maintain the average railroad mile in the United States.

That is what we mean when we talk about "cheap water transportation." Of course the difference lies in the fact that the taxpayers pay for the water transportation. The taxpayer, you know, is an amiable goat who is so used to paying that he hardly knows what he does pay for, anyhow.

A Word About Truck Transport

When you get over on the truck transport side, the truck people say they pay more than they should. A lot of studies have been made on that, by people representing the American Association of Railroads, people representing the Federal Co-ordinator of Transportation, the truck people, and others, but I have noticed this: In only three states have the responsible authorities made studies and announced their results. When I say "responsible authorities," I mean the men who are responsible for getting in the money, and spending it properly after they have it in; the men who have to raise so much revenue to keep up so many miles of highway under such and such traffic conditions.

The three states that have made such studies—Illinois, Missouri and Utah—all agree that heavy highway haulers are paying but a fraction what they should in order to insure adequate maintenance of highways. In some cases it was found they were paying as little as one-fourth of what they should pay to meet fully the cost which their heavy use of the roads imposes on all the rest of us.

So that is what we are up against in the railroad business. We are self-supporting, and we should be. We are taxpaying, and we should be. But by the same token, so should every other form of transportation stand on its own two feet, pay its own way, meet its own costs, and help support the general operations of government, public institutions and public education.

Under such conditions, the inherent advantages, the real economy, the actual cost of doing transportation by each of the various forms of transport would stand out, because we would all have to put our costs, whatever the costs were, in the rates, and not just part of it in the

rates and the rest of it on the taxpayer, to be paid by somebody else.

Step in Right Direction

A significant thing happened this year. Congress passed the Transportation Act of 1940. It is not a perfect act; it is not going to cure railroad troubles. It is not going to produce perfect equity and complete equality in our transportation world, but it is a step in the right direction.

One thing in that act is highly significant. For the first time in the history of transportation legislation, the Congress of the United States has said to the regulatory authorities which it has set up, in effect, that we, the Congress, expect you to treat all forms of transportation alike in your regulation of their activities.

How significant that is! Its full significance is only apparent when you look at the previous state of the law. The railroads were regulated. The air lines were regulated, too, but that regulation has been largely promotional, and not restrictive. The Interstate Commerce Commission was instructed by Congress in 1920 to foster, encourage and promote water transportation. It was directed by Congress in 1935 to foster, encourage and promote highway transportation. But not until this good year 1940 has Congress ever said to the Interstate Commerce Commission, in effect, that we expect you to see that railroads are equally treated with these other forms of transportation.

That is not going to put any big money in our pockets right away, but in the long run it will have its effect as an expression of the public will through congressional action. Sooner or later the time will come when these railroads will be treated equally under the law with other forms of transportation.

(Mr. Henry then pointed out that in spite of the depression the railroads are in better position to render service than they were ten years ago. He portrayed in dramatic fashion the limitation of the highway carriers, even with super-highways, to handle the vast transportation necessary in connection with the national defense program. He referred to an advertisement urging people to patronize the trucking companies as a contribution to the relief of unemployment; in it the statement was made that it takes ten times as many men to handle a ton of freight per mile on trucks as it does on railroad trains.

He pointed out, also, that the railroads did not break down in 1917, but that their inability to function was due to the fact that exceedingly poor judgment was used by government authorities in applying priorities. "There were times in the eastern part of the United States," he said, "when yards had 85 per cent of their cars bearing the red government priority tag, and nobody could tell the poor yardmaster which priority had priority over all the other priorities. . . . The railroads didn't break down in 1917 as transportation machines. They weren't used as transportation machines; they were used for storage purposes."—Editor.)

Military Transportation Section

That sort of thing [the 1917 congestions] is not going to happen again, for one thing, because of a better understanding between the railroad industry and the government. We have set up, as part of our car service, a military transportation section, with offices in the War Department. Its job is to find out what the Army and Navy want in the way of transportation, and to arrange for it. It had a great test in August of this year.

At the peak of the World War, we moved in one month an average of 20,000 troops a day. That was in July, 1918. In three days in August—the month before last—with nobody knowing it, and with no excitement except a little bit around the immediate areas where the troops were concentrated, we moved an average of nearly 40,000 troops a day—nearly twice the size of the biggest average daily movements during the World War. That is organization, performance, and we can do it again.

During several months of this year there has gone through the Port of New York substantially the same amount of export freight that went out in the peak year of the World War. This was done so smoothly this year and so quietly, so efficiently, that almost nobody knew of it.

Railroads Ready for Emergency

Here is a major element in defense, the mass transportation that ties the whole thing together—that enables us to produce automobiles, trucks, airplanes, guns, powder, shells and all the other things that may be needed in this country. We couldn't produce any of those things in quantity but for the dependable mass service of the railroads. It is a reassuring fact that this underlying fundamental element is ready. It is asking nothing of government, it is asking nothing of the public, it is asking only one thing—that so far as may be, and as soon as it can be done, we should be put upon the same footing under the law as every other form of transportation, and that we be treated as the others are treated. When we are, this last railroad problem we have—the problem of making a living—will be solved.

We may have another railroad problem if this isn't solved—the problem of a bankrupt, broken-down system of railroads, dumped upon the doorstep of Uncle Sam—but I am hopeful that the people of the United States will learn the facts and see the facts. And that is our job, the job of the railroad business—not just the job of a few of us in the railroad business but the job of all of us—to acquaint the public with the true facts about the railroads. So I come back to where I started. The job of every man in the railroad business is to help see to it that people understand and appreciate what these railroads are, and what they do, and what they mean, and what they need to do better. If all of us do that, we will get what we need—fair and equal treatment under the law with every other form of transportation business. (Applause.)

K. C. S.—L. & A. "Southern Belle"

(*Continued from page 525*)

have aluminum cast surfaces with non-skid feature. Cars are provided with complete rubber closures at the vestibules so as to give the smooth, continuous side effect desired for streamlining. Diaphragm faces are covered with carpet for sound deadening, and all contacting surfaces are insulated to prevent noise.

All interior finish, partitions, bulkheads, sliding or swinging doors, have been insulated or equipped with anti-squeak tapes to eliminate interior noise. Parcel racks, lighting fixtures and decorative molding are aluminum natural finish.

Trucks

Four-wheel trucks are used on all cars. The trucks are the single drop-equalizer, swing-motion type, with alloy-cast-steel frames of which the pedestals are cast integral. Both equalizer and bolster springs are helical coil design of alloy steel. Vertical motion is controlled by shock absorbers, and truck bolsters are restrained longitudinally by the rubber-cushioned bolster anchor

rods. Lateral sway is controlled by the stabilizer arrangement which replaces the conventional spring plank. A. S. F. roller-bearing wheel units are installed using SKF roller bearings. Clasp brakes are of the Simplex Unit-Cylinder type.

Sound-deadening materials are used at bolster springs, truck center plates and body side bearings to isolate truck noises completely from the car body. Sound-deadening materials are also used at moving parts of coupler and face-plate mechanism.

Locomotives

The Diesel-electric locomotives, with a rating of 2,000 hp. each, are capable of a top speed of 117 miles an hour, but are designed in general to cover fast schedules with low rather than the high maximum speeds. This performance is made possible by the ability of the locomotives to accelerate and decelerate quickly, maintain speed on grades, take curves fast with safety because of their low center of gravity, and because frequent changes of locomotives are not necessary nor are frequent stops made for fuel and water. The locomotives have high initial tractive force which promotes fast and smooth train starting.

Provisions for the comfort of the engine crew include deeply upholstered, adjustable seats, the one on the engineman's side being placed so that the control levers are readily accessible. Special acoustical treatment insulates the cab from engine-room and outside noises, making it possible for the engineman and fireman to converse without appreciably raising their voices—another feature contributing to safety because of the greater ease in exchanging signal observations.

A Vapor-Clarkson automatic oil-burning boiler in the rear of the locomotive supplies steam heat for both the locomotive and passenger cars. Each locomotive carries 1,100 gal. of train-heating boiler water and 1,200 gal. of fuel. With a full supply of fuel, boiler water and sand, the total weight of each locomotive is slightly less than 300,000 lb. It is 71 ft. long, 14 ft. above the rail and about 10 ft. wide.

Service of Firebox Materials

(*Continued from page 535*)

num steel plate, the molybdenum remains in the ferrite and the surface retains a greater strength that the steel plate without this material. Surface strength, then, may be improved by the selection of an alloy which enters into solution with and strengthens the decarburized layer, remembering, of course, that the alloying material used must be capable of giving the surface increased strength at elevated and operating temperatures.

The study of the third factor, aging, has not, as yet, been as fruitful as the first two factors. As you can see, this is a very complex problem, and its cause even now is not well understood. Its effects are easily measured and observed. We are now attempting to develop a means of measuring the capacity of a steel to age, and I may say that to date the results are very promising. When we are able accurately to evaluate steels according to their aging properties, we may determine more certainly the cause for this unusual phenomenon. Present knowledge seems to indicate that steels showing a marked susceptibility to peaks in the blue-brittle range, as shown in the graphs, are more susceptible to aging than those which are less affected in the blue-brittle range. We believe a steel will be developed to resist aging, as our research shows promise for such a material.

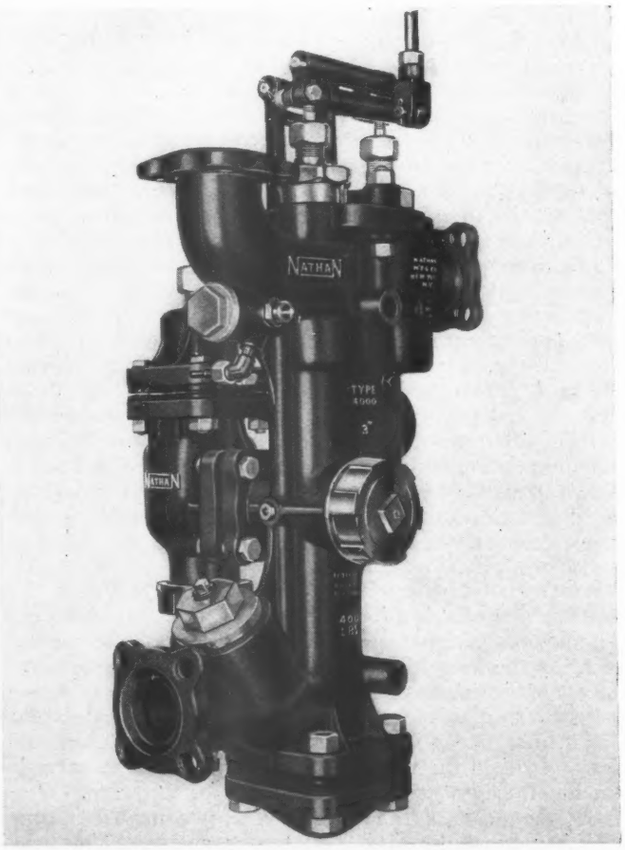
New Nathan Injector

A new type of injector has been introduced by the Nathan Manufacturing Company, New York, to supply a demand for an efficient boiler feed on high-capacity locomotives. This injector is equipped with an automatic restarting overflow which enables it to handle very hot tank water, permits a much finer regulation of the water supply than obtainable with a conventional injector and delivers the water to the boiler at higher temperatures. The outstanding advantage is that these improvements are obtained without sacrificing the restarting feature of the open-overflow type injector.

The injector will restart automatically even though the feedwater supply is interrupted momentarily. This is a new accomplishment in closed overflow operation and its value from a safety point of view is apparent. Especially at high speeds and with a low water level in the tank, surging of the water may cause the tank valve to become uncovered, causing the injector to break. Under these conditions the overflow is opened automatically, a steam blow-back into the tank is prevented, and the injector is in a restarting position as soon as the water supply is re-established.

One lever operation controls both the water and steam. As the operating lever is moved to regulate the injector, the proper relation of steam and water for highest efficiency is produced automatically.

The injector is both lifting and non-lifting and therefore may be located at the most convenient place on the locomotive. All parts are designed for a working pressure of 400 lb. per sq. in. to assure long life and low maintenance.



The Nathan Type 4000 injector is equipped with an automatic restarting overflow

EDITORIALS

Detailed Car Repair Costs

Time and labor required for the thorough analysis of detailed car-repair costs are well spent indeed. Take, for example, the figures compiled by an important western carrier for repairs made over a period of five years to a group of 100 single-sheathed box cars 20 years old. The total cost per car per year for repairs was $109.29, which may be compared with $59.28 per car per year for a similar group of 100 single-sheathed box cars only 10 years old. In the first instance, it is interesting to note that the largest single item of expense was for flooring, $22.05 per car, or 20.2 per cent of the total cost of maintenance per car per year during this period. The next largest item was $15.05 for lining. The application of a complete roof cost $11.06 and wheels $10.25 per car, per year. The total inspection cost $7.09; car doors, $4.63; draft gears, $4.17; and air-brake cleaning, $3.98 per car per year during the five-year period studied. On this road the average annual repair cost per car, or the total of Account 314 charges divided by the total freight cars owned, amounted to an average of $63 per car per year for the period.

Railroad Rolling Stock Being Reconditioned

With revenue freight-car loading at least 10 per cent higher than a year ago and net operating income in July, for example, 16½ per cent more than in July, 1939, it is interesting to note what the railways have been doing in the way of equipment maintenance and reconditioning. During the first six months of this year, the railways spent $397,126,782 for maintenance of equipment, an increase of $30,900,439, or 8.4 per cent over the first six months of 1939. With a somewhat smaller number of freight cars on line, the number of freight cars awaiting repair as of August 1, 1940, was 144,432, or 84,109 cars fewer than a year ago. Similarly, the number of locomotives needing repairs, as of August 1, 1940, was 6,506, or 1,933 less than on August 1, 1939.

A study of the records for revenue freight-car loadings indicates that they are running roughly 10 per cent higher than for corresponding periods a year ago and 20 per cent higher than two years ago. If present trends continue, the railroads may expect to have to handle close to 950,000 revenue freight-car loadings during the peak week of the year, which usually occurs about the middle of October. It is gratifying to note, therefore, the attention given in recent months to reducing the amount of equipment held awaiting repairs, for it will all be greatly needed during the peak loading period if car shortages in all classes of equipment are to be avoided and sufficient motive power be available to move the trains promptly.

No doubt particular attention will have to be given to particular classes of cars which may be in greater demand than other classes. For example, present demands for the shipment of national defense traffic requiring large capacity box cars indicates a need for supplementing the supply of 50-ft. box cars as fast as practicable and handling them in such a way as to assure prompt return to the owners for reloading with minimum delay.

Boilermaking With Micrometers

Workmanship is an important factor affecting the performance of any machine. The remarkable dependability and low cost of the automobile is sufficient proof that precision methods of manufacture are justified. It has taken the competition of locomotives powered by internal combustion engines to accelerate improvements in the steam locomotive and to show the need for not only better designs but for construction methods of more scientific exactness. Most of these improvements have been in the form of refinements in the running gear and motion work. More recently, attention has been directed to the fact that the boiler construction methods of yesterday must be revised to meet the requirements of the high-capacity locomotive of today.

Boilermakers have, for the most part, looked upon micrometers and what they stand for as complete strangers. Among the many expressions used in the backshop none has been spoken more frequently than "His rule only reads to the quarter inch, he's just a boilermaker." This remark may have been spoken in a joking manner, yet it typifies the relative crudeness with which boilers have been fabricated. It may be argued that a part as large and awkward to handle as a boiler course or shell does not lend itself to the precision

methods employed to form the smaller machinery parts. However, locomotive builders and a few railroads have not only recognized the need for better constructed boilers but are actually building boilers to tolerances associated in the past with work finished on machine tools. Boiler courses formed to fit together within five thousandths of an inch, cylindrical courses that are really round, sheets shaped to make a metal-to-metal contact with the connecting part without forcing, rivet holes drilled and reamed to the exact size are only a few of the refinements being practiced.

A committee of the Master Boiler Makers' Association, in submitting a report on boiler fabrication at the 1940 annual meeting, showed that this organization recognized the value of using more care and skill in the construction of boilers. In presenting this report the chairman stated, "The committee desires to recommend to the association only such methods which we know are attributes of first-class workmanship. We believe the standards set up by the association should be consistent with the scientific design of boilers and the demand which is being made for keeping the power in operation continually." This group of practical men are doing their bit towards keeping the steam locomotive in a position to meet successfully any competition. The subject is of such importance to the association that it recommended the study be continued in co-operation with the A. A. R. and the locomotive builders with the setting up of standard practices for boiler construction as the objective.

The trend toward better fabricating methods is partly the result of the boiler problems created by the use of higher pressures and the introduction of alloy steels. It has also been influenced by the investigation of embrittlement in which poor boiler construction has been found to be one of the contributing causes. Regardless of the reasons, it is certain that the locomotive boiler receives enough rough treatment in service without being placed under an initial handicap by anything less than the best workmanship.

Applying Locomotive Crank Pins

One of the editors of this publication recently heard what sounded like a small explosion as a suburban train was leaving a local station and, on going up ahead, discovered that the locomotive motion work was pretty well stripped on the left side, with the rods disconnected and the piston half out of the cylinder due to failure of the left main crank pin. A rough measurement indicated about two-thirds old break and one-third new fracture in the crank pin just inside the wheel seat. Fortunately, the crank pin failed before the locomotive had reached any appreciable speed, consequently the damage was relatively less than it might have been.

The entire question of driving-wheel maintenance, particularly as regards the application of both axles and crank pins, is being intensively studied by railway mechanical officers with a view to preventing even the occasional failures which present such a hazard to railway operation. In the instance cited, it is obvious that the progressive fracture in the crank pin could not have been detected by casual inspection. The partial or complete removal of the pin, however, and testing with the Magnaflux method would unquestionably have shown up the progressive fracture.

It appears clear that definite and possibly somewhat shorter periods of service life should be specified for axles and crank pins, especially in locomotives assigned to high-speed schedules, and apparently, in some instances at least, it will pay to review carefully every detail of wheel-shop practice and make sure that the latest approved procedure is followed, as well as the best modern machinery and equipment utilized to reduce failures to a minimum. Railroad shop men and terminal forces are notably ingenious in getting tough jobs done by one means or another, but uncontrolled methods and inadequate tools cannot be tolerated in such vital operations as wheel and axle reconditioning work.

What Is A Railroad?

Two of the addresses by railroad officers at the open meeting of the Association of American Railroads, held at New York on November 13 and 14, discussed the future of the railroad industry with a shift of emphasis from the points at which most such discussions have been directed. One is ominous in its note of warning; the other sounds a distinct note of optimism. Considered together, they present a challenge to the leaders in the industry—the responsible officers of the organizations which represent and lead the workers in the industry. Together, they cover both of the essential relationships of the industry: that between the managements and the employees and that between the railroad organization as a whole and the public it serves. Both stress the significance of the change from the days when railway transportation constituted a monopoly to the highly competitive situation in which the railways must fight for their lives today.

The Monopoly Mind in Employee Relations

Jacob Aronson, vice-president, law, New York Central System, speaking on the need for labor's cooperation, said that "for some years it has been obvious that, for all practical purposes, competition has superseded the constitutional right of a reasonable return on investment. Rates no longer can be made on the primary basis of the cost of service (that is to say, on the basis of producing a reasonable return on the cost or value of the plant) but must take cognizance, and frequently paramount cognizance, of com-

petitive conditions. Railroad management has come to an awakening, sometimes to a rude awakening, that prohibitively high rates frequently 'kill the goose that lays the golden egg!'

"Railroad labor might well take a leaf out of this book. Proposals that are economically unsound, that ignore the existence and expansion of competition and that entail cost beyond the legitimate capacity of the industry, are not only negatively shortsighted, but constitute affirmative injury to the very ones intended to be served. To the extent that artificial impediments are insisted on, which make the cost of rendering the service prohibitive, the business dries up. Employment is then reduced and the juniors find themselves on the "extra" board. . . .

"If the responsible heads of the Railroad Brotherhoods will call a truce on all efforts to create unwarranted jobs and working conditions and will unite with management in a concerted and vigorous effort not only to retain to the rails the traffic which now moves over them, but, as well, to get their full share of any expansion of business, they will undoubtedly be doing more to create additional jobs and heavier pay envelopes than can be accomplished in any other way."

The Monopoly Mind in Customer Relations

E. E. Norris, president of the Southern, speaking on the need of the railroads to rid themselves of the "monopoly mind" said that he liked to think of a railroad "not as an aggregate of inanimate locomotives and cars and tracks and buildings, but as a virile army of men and women working together to provide an essential service. I like to think of a railroad in terms of human activity, rather than in terms of physical property. . . .

"From this concept of a railroad, stems the thought that the improvement of railroad service must concern, *first of all,* the men and women who comprise the railroad family. That means the fellows at the top, those at the bottom, and all those in between. That means that the *starting* point for improvement in railroad service must lie in the minds of railroad people—in their attitudes; their mental processes; and their resulting actions. That means that if we really want to improve railroad services we've first got to improve our will and our capacity to please. . . .

"We must remember—and we must forget, at the same time—that, for 50 years, the railroads had a monopoly in transportation. That fact naturally produced what we might call—for want of a better name—the "monopoly mind" in *all* the ranks of railroading. . . . We have competition now everywhere—keen competition. Our competitors are young and vigorous. Their personnel has no inhibitions; no heritage of monopoly attitudes. . . .

"If you don't believe there *is* a difference between the attitude and actions of railroaders generally and the attitude and actions of the workers in competing transport agencies, try what we tried on the Southern Railway a year or so ago. Gather together a group of the keenest minds on your railroad. Tell them to forget that they ever earned a nickel of railroad money. Then send them out to call at railroad stations and offices, at airline terminals, and at the offices of the bus and motor truck lines. . . .

"The report your men will turn in—if it is free of prejudice—will probably shock you. In fact, I'll guarantee that it will! Our report from just this procedure certainly jolted us. So much so, that we still consider the job of *humanizing* the Southern Railway to be our *first* objective in the fight to live as a solvent, useful enterprise. So much so, that I am convinced that the first and most important step in any sincere effort to improve railroad services is the task of finding some cure for the hang-over from yesterday's monopoly jag."

Impaired Confidence Must be Restored

Taken together, these two addresses present a remarkably clear picture of what must happen if the railway is to marshal its forces for the fight to keep and develop the field of transportation to which it is legitimately entitled. Mr. Norris emphasizes the need of the railroads to rid themselves of the monopoly mind in their relations with the public. Mr. Aronson asserts that the employees must get rid of the monopoly mind in their relations with the managements and, through them, with the public.

Herein lies the challenge to management. The accomplishment of these two essential changes in attitude places a responsibility on railway officers to take the lead in improving the "will and capacity to please" in all employee relations. But it will not be enough that these relations be established on a more warmly human basis. The same forethought and skill must be brought to bear on the development of a campaign of education for improving these relations that has been and is being devoted to the present campaign for the improvement of the relations of the railroads with the public.

And above all, such a campaign, to have any possibility of succeeding, must be wholly free from sharp practice, or half truths. There must be complete candor if the confidence of employees in management—which too much preaching of class consciousness and class hatred during recent years has impaired—is to be restored. Until that confidence is restored, there is little hope of making real headway in the educational part of the program to rid railway employees and their leaders of the monopoly mind which justifies "importunities for continual Congressional discriminatory favors at the expense of the railroad industry." Until that confidence is restored, the railroad will continue to be a complex aggregate of physical property subjected to the abuse which comes from the cross purposes of the men who manage it and the men who operate it. Only when that confidence has been restored is there hope that it may again become "a virile army of men and women working together to provide an essential service."

The "Igloo" occupies a space 25 ft. by 55 ft. when buried under eight carloads of sand

A. C. L. "Igloo" Sand Drying House

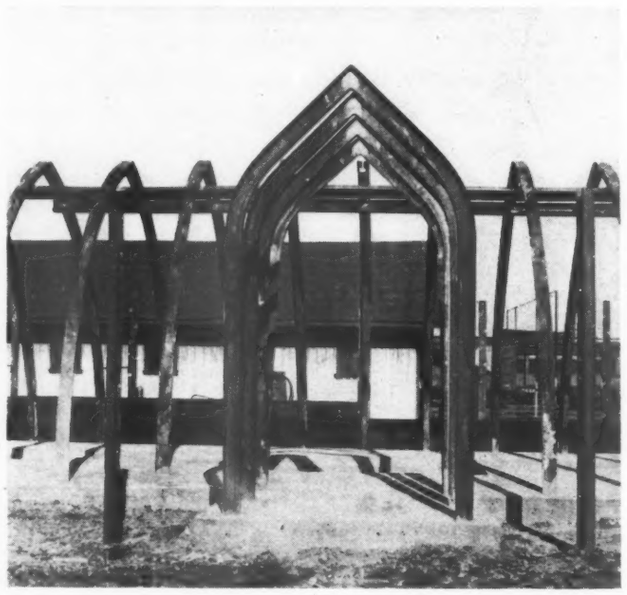
*By C. L. Meister**

In May of this year an unusual type of sand drying house was placed in operation at the Florence, S. C., shops of the Atlantic Coast Line. It is called the "Igloo" because the lines of the roof are similar in appearance to those of the Eskimo dwelling. The house was designed especially so the sand could be unloaded from the cars by the shop crane, dumped directly on the roof, and then made to flow by gravity to a convenient location near the stoves, thus reducing the labor requirements for handling.

The sand house was constructed of old rail, scrap roof sheets from old cars, condemned air reservoirs and other second-hand material with a suprisingly small cash expenditure for foundation materials and some valves and fittings. The frame is made of the old rails which have been bent to form the slope of the roof and set in concrete as shown in one of the illustrations. The roof and sides are of 3/16- or 1/4-in. plate. The side sheets only extend down to within three feet of the ground, leaving an opening through which the sand falls inside the house near to the stoves. The sand house was set inside of a retaining fence and occupies a space 25 ft. by 55 ft. with eight carloads of sand.

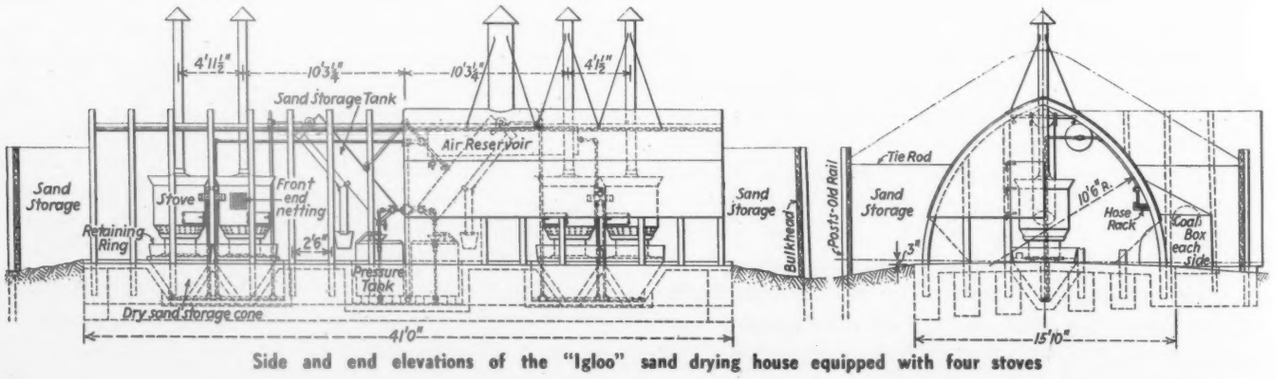
The dry sand drops into concrete-lined conical pits under each stove from where it is carried by compressed air to one of two storage tanks that are installed near the center of the house at an angle of approximately 45 deg. as shown in the diagram. The sand falls from these tanks directly into pressure tanks and then is lifted by compressed air to two large outside tanks set high above the tracks, where it is available to replenish the supply on the locomotives.

The sand is screened three times before it reaches the outside tanks. There is a screen in the top of the conical pit under the stove. It is screened again as it is blown into the storage tank and it goes through another in the funnel that guides the sand into the pressure tank. Trash material, which is caught by the screen at



Old rails welded together form the frame of the sand house

* Mechanical engineer, Atlantic Coast Line.



Side and end elevations of the "Igloo" sand drying house equipped with four stoves

the top of the storage tank, is conveyed through a pipe to a bucket suspended under the tank.

Since placing this sand drying house in operation, it has been found that about 50 per cent of the moisture in the sand on the roof is removed by natural evaporation and the elimination of the balance requires but a small amount of artificial heat. During the past summer only two stoves were fired and even these were allowed to go out for several days at a time. The average demand for sand at the Florence terminal varies from three to four tons per day in the summer months to over six tons a day during the winter season. It is the intention of the Atlantic Coast Line to build, as required, similar sand houses equipped with two, three or four stoves at other locomotive terminals.

Laying Out Shoes and Wedges On a Vertical Turret Lathe

A Bullard vertical turret lathe with a universal chuck can be used to advantage in laying out shoes and wedges. Here is how it can be done.

Place the driving box on the boring-mill table and if it is found to be out of center, as shown in the lower right corner of the accompanying drawing, a liner or parallel is placed in the chuck on the thin side of the box, before the box is bored. One-half the thickness of this liner is the distance the box is out of center.

For example, the driving box shown is 18½ in. wide and a ¼-in. liner is placed on the thin side of the box before boring. One-half the thickness of the liner, or ⅛ in. is the distance the box is out of center. Since the shoes and wedge are laid out at a standard 1 in. thickness, it is necessary to add to the shoe the distance of ⅛ in. that the box is out of center, making the shoe 1⅛ in. and to subtract the same distance from the wedge making it ⅞ in., or vice versa.

This saves the time of centering each box and by using this layout for shoes and wedges, the locomotive may be laid out before the boxes are bored, as the work is done from the center of the driving box and not from the frame centers. This eliminates marking the centers on the frame, except on the main jaw and the spring rigging may be left on or applied to the engine during the layout, except on the main jaw.

Then proceed to layout the shoes and wedges according to the standard method, as shown. This method can be used on all types of locomotives.

Another time saver in this method of shoe and wedge layout is that if the main center is out of square, the error can be placed all on one side of the frame. This saves the time of dividing the error on the frame, because this can be done easily, on paper or mentally. For example, the center on the main frame is out ⅛ in. and the box is 18½ in. at the 1-in. shoe-and-wedge layout. When the error is divided the shoe will be $^{15}/_{16}$ in. and the wedge $1^{1}/_{16}$ in.

Locomotive Boiler Questions and Answers

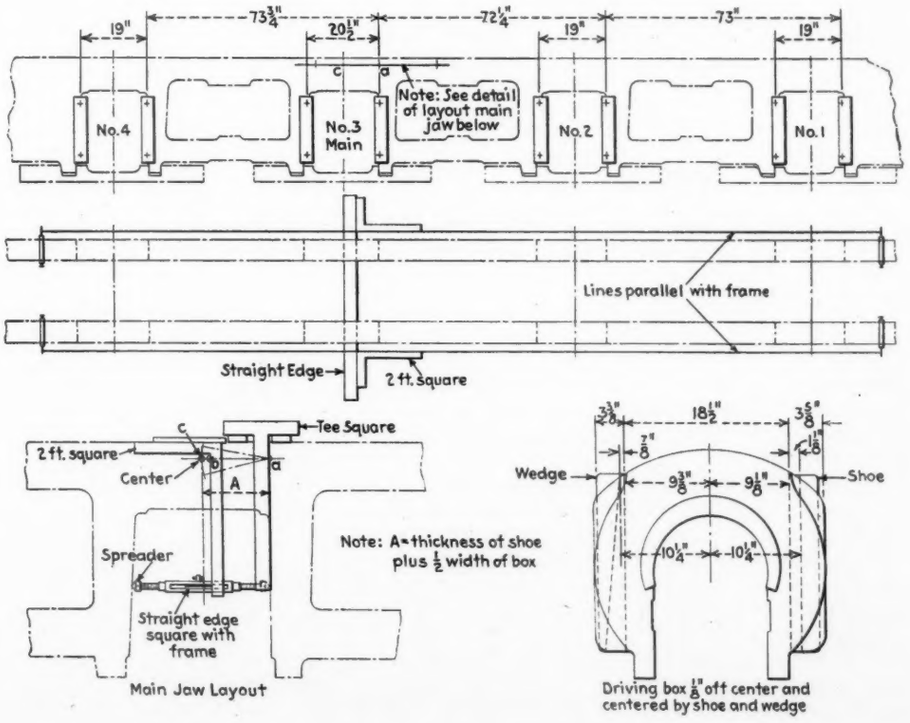
By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Repairing Grooved and Corroded Wrapper Sheets

Q.—The wrapper sheets of several of our Pacific type locomotives are grooved and corroded directly above and running

(Continued on page 549)



Drawing of frame and driving box showing method of laying out shoes and wedges

Evans went, and looked. The night foreman went with him. The overhead crane was perched on top of the smokebox

IT'S AN ILL WIND

by

Walt Wyre

MAYBE Confucious said it and maybe he didn't, but every railroad man knows when things are running along smoothly trouble is not far behind. Everything in the S. P. & W. roundhouse at Plainville had been going smooth as a ballbearing baby carriage going down hill. There hadn't been an engine failure or a personal injury in nearly thirty days. Things had been going so nicely that Jim Evans, the roundhouse foreman, who has been going to quit railroading for twenty-eight years, had just about decided to stay with it.

The chief despatcher started the trouble when he called the roundhouse office Wednesday morning and said that there would be a heavy shipment of cattle Saturday and that two 5000 engines would be needed.

"That should be easy," Evans said. "The 5088 should be ready to go and the 5092. This is one time we are one jump and two engines ahead."

The boilermakers were renewing the side sheets of the 5088 and machinist Jenkins had just started to bore the cylinders of the 5092. The boilermakers were just about ready to start driving rivets at the time the despatcher called.

Evans took a turn through the roundhouse and then went back to the office. The foreman had just settled down comfortably with his feet on the desk when a boilermaker helper came in.

"There's not enough air to drive rivets," the helper said.

"What's the trouble; isn't the air compressor running?"

"I don't know," the helper replied. "Barton just told me to tell you there wasn't enough air to drive rivets."

At that moment Louis Johnson, a machinist, came in. "The air compressor is broke down," Johnson said. "I was passing by the stationary and heard the compressor pounding like it was going to start flying to pieces any minute. I shut it off."

"Did you find out what's wrong with it?" Evans asked.

"Well, for one thing, two crank shaft bearings are knocked out. Don't know what else is wrong with it."

"That's enough!" Evans got up and started out to look at the compressor. The machinist went with him. "They've been promising us a new compressor for the past seven years," Evans said when he looked at the machine. "If they're ever going to get one it's time they did it. W've spent enough patching up this one to have bought at least two. Get your helper and take the bearing caps off and see what condition the shaft is in," Evans told the machinist.

When the foreman left the stationary room he met machinist Jenkins. "I've got the boring bar set up to start boring the left cylinder and there's not any air," Jenkins told the foreman.

"It may be tomorrow before we get the air compressor going," Evans replied. "You can take the heads off the other cylinder and get it ready while you're waiting."

It was but a matter of minutes to loosen the cap screws that held the bearing caps and it took less time than that to tell that the shaft would have to be smoothed before pouring new bearings if it was to run. The machinist and helper worked the rest of the day and an hour overtime. The shaft needed grinding but they weren't prepared to do it even if they had time. They knocked the worn spots off with a mill file, then polished it with emery cloth, poured new bearings and called it a job.

NEXT morning just before eight o'clock, Evans went out and started the compressor. It sounded like twin pile drivers driving steel piling through bed-rock. The foreman hurriedly closed the throttle and went to find machinist Johnson.

"Say, that compressor sounds like it was ready to fly all to pieces. Better take a look at it soon as the whistle blows."

"What are we going to do for air to drive the rivets on them side sheets?" Barton, the boilermaker, asked.

"Well, I guess we'll have to use an engine. I'll tell the hostler to run the 5091 in and use it to furnish air for the roundhouse. The car department will just have to get along somehow until we get the compressor going again."

The air pumps on the 5091 worked faithfully and well, but just didn't have the capacity for the job. It seemed that every one that ever used air at all needed it that day and there wasn't enough. The painter spraying paint, the blacksmith forge, the pipefitter's furnace, a rivet forge—all required air to operate and all were in use. Evans noticed a machinist using an impact wrench or rather attempting to use one with about forty pounds of air and stopped him. He felt like firing the laborer that cleans the machine shop when he found him using air to blow dust and shavings out of the machines.

The foreman stopped and watched Jenkins trying to bore a cylinder. The air motor sounded like a fat man climbing a mountain and was making about as much headway. Evans had threatened several times to rig up an electric motor to run the boring bar, but hopes of eventually getting a new boring bar already equipped with a motor had been partly responsible. Then, too, when using the boring bar there wasn't time and when it was not in use no one thought about it. Evans watched a few minutes and decided it would save time in more ways than one to do it then. It would at least allow more air for other jobs that needed it.

"Say, didn't you tell me that you had a two horsepower motor that wasn't in use?" Evans asked Ned Sparks, the electrician.

"There was one here," Sparks replied.

"Where is it now?"

"It's in the lumber shed if the storekeeper hasn't sent it in," Sparks said. "Do you want me to see?"

"Yes; bring it up here and see if it's in condition to run. Get it right away; I want to hook it up to run the boring bar."

The motor was still in the lumber shed and in condition to run, but there were no pulleys of the proper size available. Evans hadn't considered the fact that the electric motor ran at approximately 1,800 r. p. m. while the air motor only ran about two hundred. That would require a nine to one reduction to operate the boring bar at the same speed as did the air motor; however, the boring bar speed could be increased slightly without running too fast.

The foreman decided that a 3½-inch pulley on the motor and one of 28 in. diameter on the boring bar would be about right if he had the pulleys. The smaller one could be turned in the machine shop, but the larger one couldn't. He searched the place over, but there wasn't a pulley of even approximately the right size to be found. He was ready to give up and continue to try to use the air motor until a pulley could be ordered. He went to the storeroom to tell the storekeeper to order a pulley.

The storekeeper had stepped out a few minutes and Evans looked around in the storeroom while waiting. He happened to glance up and saw what appeared to be the rim of a pulley projecting over the edge of a material rack. He climbed up for a look. What he thought was a pulley was one of four brand new wheels for a truck. Evans started to get down then changed his mind and climbed up for a better look. He took one of the wheels and climbed down. He measured the wheel. It was 26 inches in diameter, the rim was 3 inches wide.

The storekeeper came in while Evans was measuring the wheel. "That's one of the wheels for our truck," the storekeeper said. "Do you want me to order you some of them?"

"No; order one for yourself," Evans said, "unless you can get along with three." The foreman started off carrying the wheel.

"Say, you can't do that!" the storekeeper yelled. "I need that wheel!"

"Not as bad as I do," Evans replied and kept going.

The bore of the wheel was too large for the shaft on the boring bar, but that was soon corrected by making a bushing. A machinist made a pulley for the motor out of a piece of brass.

"How are we going to fasten the motor," the electrician asked.

"Well, let's see," Evans pondered a moment, "I'll bolt it to a piece of heavy oak timber that should hold it."

It took half of the day to get the motor rigged up to run the boring bar, but it did a good job. The machine cut faster and smoother and left more air for the riveting job.

Friday at noon both engines were ready to go. Evans

went home that evening feeling pretty good. Two whole engines ready to go twenty-four hours before they were needed! That's enough to make any roundhouse foreman shake hands with himself.

Untroubled and for once without worry, Evans slept like a tired child and woke up next morning feeling fit as the proverbial fiddle. The motor of his three-year-old car purred like a kitten as he drove to the office. The night foreman came out to meet Evans looking like the personification of bad luck hunting a place to happen.

"What's the matter?" Evans asked. "Have a hard night?"

"Go look in the machine shop," the night foreman said.

Evans went, and looked. The night foreman went with him. A 5000 locomotive had its pilot jammed into the brick wall at the end of the machine shop. The overhead crane was perched precariously askew on top of the smoke box. Cables, trolley wires, and twisted angle irons were tangled in what looked like a hopeless maze.

Evans, looking a year older at each step, walked to the front end of the locomotive. The headlight was smashed beyond repair, both classification lights were broken off, and the stack light was crushed under the crane.

"I was afraid to try to pull the engine out," the night foreman said, "afraid the crane would fall."

"How did it happen?" Evans asked dolefully.

"Well, you see there wasn't any air pump on it," the night foreman explained. "The pump was reported and after we took it off to change it, I decided to change a pair of tank wheels that had been running hot." The night foreman sighed deeply and went on. "I asked the hostler if he could run the engine over the drop pit without any air and he said he could. There wasn't much steam on her; if there had been I guess it would have took out the whole wall. Anyway, he cut steam in the air reverse and spotted the engine on the table without any trouble. When he tried to stop on the drop pit the throttle stuck open and the reverse wouldn't work."

"Well, it's a helluva mess," Evans commented. "Good thing the engine wasn't called."

"But it was called," the night foreman said. "It was called to run west on an extra. There was an hour and ten minutes delay getting the 5092 ready."

"Well, I'll have to dig up another engine for one of the cattle trains," Evans commented thoughtfully. "There's still the 5088."

"I run it east on 72," the night foreman admitted. "The 5076 that I was figuring on had flat spots on the right main driver. I would have run it anyway, but I got word that the Federal Inspector was on the east end of the division."

"O. K.," Evans said as though he were facing a firing squad and ready for them to shoot. "I'll get along some way."

Machinist Johnson in the meantime had torn down the air compressor and found it ready to ship to Japan as scrap iron. Among other parts required to put the compressor back in service was a complete set of valves.

Evans had already told the storekeeper to wire for two extra locomotive air pumps to use until the compressor could be repaired. Evans went to the roundhouse office and called the B. & B. gang to come and straighten the crane around and get it back on the track so the locomotive that was under it could be pulled back. For once the gang was in town when needed and would be on the job at eight o'clock. That helped some, but didn't provide the two engines promised for the cattle trains and didn't get the ones out for the regular trains.

When the whistle blew the foreman lined the work out and got the men started on the daily routine. He told the electrician to look at the damaged engine and get the necessary repairs together to fix it up as soon as it could be pulled back in the clear. A machinist was told to take the dome cover off and see what was wrong with the throttle.

About nine o'clock, master mechanic H. H. Carter came to the roundhouse. That worthy official did everything but turn handsprings when he saw the mess the 5094 had made in the machine shop. Then Evans told him about the air compressor tearing itself up. Carter swore a few verses about that. "Did you have the storekeeper wire for repairs?" he asked.

By then Evans was about ready to do a little blowing up himself and didn't care much what the result might be. "No, I haven't wired for parts for the compressor. I sent for two locomotive pumps. They've been promising us a new compressor for the past ten years and I'm through trying to keep that old wreck running. It takes half the time of a machinist trying to keep it repaired and every time we need air there isn't any."

Carter had already blown off most of his surplus steam and had cooled down somewhat. "I don't blame you," he said. "I'll wire the S. M. P. that it's impractical to repair the compressor, then maybe we'll both get fired."

The B. & B. gang made good time jacking up the overhead crane and getting it straightened around. At 10:30 they had it in shape so the 5094 could be pulled back in the clear. The machinist found the throttle disconnected and soon had that part repaired, but the front end still looked like it had come out second best in a Kansas cyclone.

AFTER checking up, the only two locomotives available for the cattle trains were the 5094 and 5076. If there had been a tire of the proper size and thickness to fit, getting the 5076 wouldn't have been much of a problem. One would have to be bored out and turned to size. The crane being out of commission complicated things, too. Not only was the overhead crane broken down, but scaffolding put up by the B. & B. gang had the way blocked so the portable crane couldn't get to the wheel lathe with a tire. Nevertheless, a tire had to be turned and Evans decided to do it if it took all hands and the cook to get the job done. He got together a gang and rolled a new tire into the machine shop and then rigged up a chain hoist to swing the tire and chuck it on the face plate of the wheel lathe. After it was bored it was a comparatively easy matter to change the chuck jaws for turning the outside of the tire.

By the middle of the afternoon a little daylight could be seen through the cloud of trouble. The 5076 was just about ready to set outside for one of the cattle trains, but the electrician was having trouble with the 5094. There wasn't a headlight in the storeroom, just one classification light, no stack light, and flexible conduit for the job would have to be ordered.

"Don't know what we would do if there wasn't usually an engine tied up," Evans said when the electrician told him about it. "Take what you need off the 5081 on the drop pit."

"That might be O. K. if you didn't need the engine until about noon tomorrow, but working alone I wouldn't have time to take all of the wiring and things off the 5081 and get them back on the 5076," the electrician said, "and besides, the flexible conduit that goes to the headlight is shorter than that on the 5076 and wouldn't reach."

"Well, get it going somehow," Evans left the proposition up to the electrician, "I'll give you a helper. Hang the lights on it so it will do to run."

It wasn't a very good looking job that the electrician did, but it at least complied with what the foreman had requested. Sparks fastened the headlight, stack light, and classification lights in place, then ran wires to them.

He wrapped the wires with a layer of friction tape and called it a job and the despatcher had his engine with only twenty minutes delay.

Next day the master mechanic came to the roundhouse and Evans told him about fixing up the motor to operate the boring bar.

"Why don't you have a wagon made to mount the motor on and get a push button starter put on it," the master mechanic suggested.

Evans had suggested doing that very thing several times before and Carter had vetoed the idea, but the foreman didn't mention that.

The overhead crane wasn't in as bad condition as it had appeared to be. After the B. & B. gang got it back on the track it didn't look near as bad as before. The light angle-iron railing could be straightened up without a great deal of work and only three trolley wires had to be replaced. The big I-beams were slightly bent but not enough to affect operation.

Then came the best news of all—a wire from the superintendent of motive power: "New air compressor will be shipped next week."

"I guess the old saying is still true. 'It's an ill wind that blows nobody good,'" Evans commented when he read the message.

Locomotive Boiler Questions and Answers

(*Continued from page 545*)

parallel with the mud ring. These wrapper sheets are 5/8 in. thick. Is it permissible to weld the corroded areas or should the corroded section be removed and a patch applied?—D. E. F.

A.—The extent and the depth of the grooved and corroded area should determine whether or not a patch would be required. Corroded or grooved portions of wrapper sheets can be filled in or reinforced by welding provided at least 60 per cent of the original thickness of sound metal remains in the sheet. Grooved or corroded areas shall not be filled in or re-inforced by welding, if the width of the area exceeds 2 in., or the length 30 in., or if the welding is in line with staybolts or studs.

Two such areas in any one plate may be filled in or re-inforced provided the distance between the re-inforced surfaces is not less than 30 in. Building up around washout openings or blow-off pipe connections shall not exceed 2 in. from the edge of the hole. If the grooved or corroded areas of the wrapper sheets are more than 1/4 in. in depth and more than 2 in. wide or 30 in. in length, the section should be removed and a welded patch applied.

Reduction in Boiler Pressure—Alteration Report Required

Q.—Is it required to file a boiler alteration report with the I. C. C. when reducing the working pressure on a locomotive, if the boiler is still capable of carrying the boiler pressure shown on the original specification card?—W. O. M.

A.—Rule 54 (b) of the Laws, Rules and Instructions for the Inspection and Testing of Steam Locomotives of Tenders and Their Appurtenances, states as follows: When any repairs or changes are made which affect the data shown on the specification card, a corrected card or an alteration report on an approved form, 8 in. by 10½ in., properly certified to and giving details of such changes, shall be filed within 30 days from the date of their completion.

It is customary to file an alteration report when any changes are made that affect the original specification card, even though no actual repair or change was made to the above boiler. The reduction in boiler pressure is a change in the information as shown on the original specification card and, therefore, should be recorded with the Bureau of Locomotive Inspection.

Flexible, Seamless All-Metal Hose

Seamlex flexible hose or tubing is extensively used on railroad equipment, particularly on locomotives where some of its applications include its use in force-feed lubricating systems, and in power reverse-gear, brake-cylinder, equalizer, signal, and booster steam lines. It is available in standard stock sizes ranging from 1/16 in. to 6 in. inside diameter.

This flexible hose consists of three essential parts, the inner seamless flexible tube, the outer covering and the couplings. The inner tube is made of a single piece of seamless tubing with helical convolutions giving it great flexibility. Due to its construction the corrugated flexible tube is as leakproof and free from seepage as the seamless tube from which it is made. For temperatures up to 400 deg. F. it is usually made of bronze. For higher temperatures steel is recommended. The inner tube is made with open-pitch corrugations for withstanding vibration and close-pitch corrugations for frequent flexing.

The outer covering consists of one or more tubular metal braids, depending upon the internal pressure to which the hose is subjected. The type of braid varies with the service in which the flexible hose is to be used. An additional outer armor is required where chafing or severe operating conditions prevail.

There are two principal classes of couplings, one being the solderless, brazeless, and packless construction for high temperatures. This class is furnished either in the flare or detachable types depending on the service conditions. The other is the triple-seal soldered coupling for use with lower temperatures. The couplings are furnished with a standard pipe thread or with any special thread that may be specified.

The flexible hose or tubing is made by the Seamlex Company, Long Island City, N. Y., with its sole sales representative being the Miller-Lewis Railroad Equipment Corporation, New York, N. Y.

The Seamlex all-metal hose is tied in a knot, indicating its flexibility

Fig. 1—The pipe and air-brake departments at the Milwaukee, Wis., shops of the C. M. St. P. & P.

Pipe and Air-Brake Shop Devices

*By T. H. Birch**

Much time and study have been given to laying out the pipe and air brake department at the Milwaukee shops of the Chicago, Milwaukee, St. Paul & Pacific. Safety First has been considered of primary importance, with the result that this shop has had only one personal injury in the last 10 years, with an average employment of about 45 men. Wherever an operation is performed in this shop, there is a sign facing the man doing the work, reminding him of safety. In addition to this, there are many operations where the use of goggles is deemed necessary; therefore, an additional sign is added which reads, "Goggles Needed." There are many other reminders of the importance of "Safety First" scattered conspicuously throughout the department. Aisleways are definitely laid out with yellow lines, and so are islands in which the various operations are being performed and where material is stored.

All operations have been analyzed and the proper sequence definitely decided on which has resulted in work being performed with the least possible number of movements of men and material. Fig. 1 is a general view of this department.

Another feature is an exhibit of sectional models of practically all the valves and equipment handled in the shop. These models have been obtained from damaged parts, so no material investment is incurred. They are a great help to the men in the shop in enabling them to become better acquainted with the work which they are doing. They are also beneficial to men employed in the

* Air brake foreman, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.

Fig. 2—Sectional models of air-brake valves and equipment.

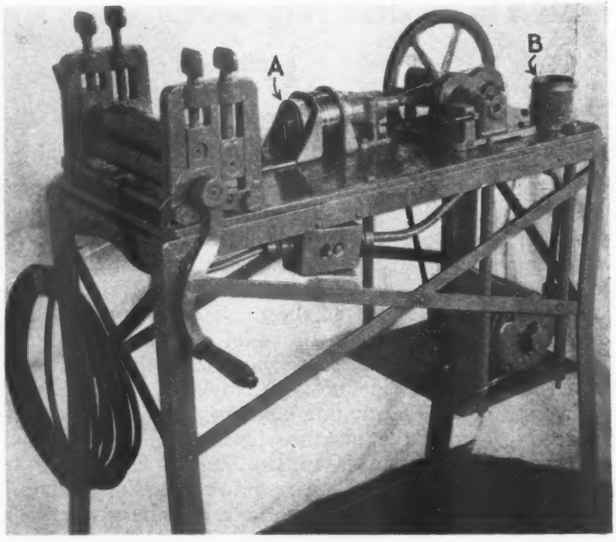


Fig. 3—Shop-made machine for reclaiming non-pressure-head brass protector rings.

Fig. 4—Bench construction with wire mesh back stop which transmits light and facilitates cleaning.

terminals, many of whom avail themselves of the opportunity to study this equipment. In addition to these models, there is a working setup of a complete D-22-A control equipment and also an AB equipment connected with both a single-car testing device and an engineer's brake valve. These two setups have proved themselves very educational and instrumental in keeping the men interested in their work. A section of this exhibit is shown on Fig. 2.

A novelty of the bench construction, illustrated in Fig. 4, is that although there is a shelf attached to the back of the bench for small material, iron mesh is used for a back instead of a solid material. This not only provides light but also facilitates the cleaning of the benches and eliminates dirty corners, for a blast of compressed air will thoroughly clean the bench. Attached to the top of this bench is a series of enlarged photographs showing the various parts and the identification numbers of the AB valves. This assists the men in immediately recognizing and becoming acquainted with the various parts used.

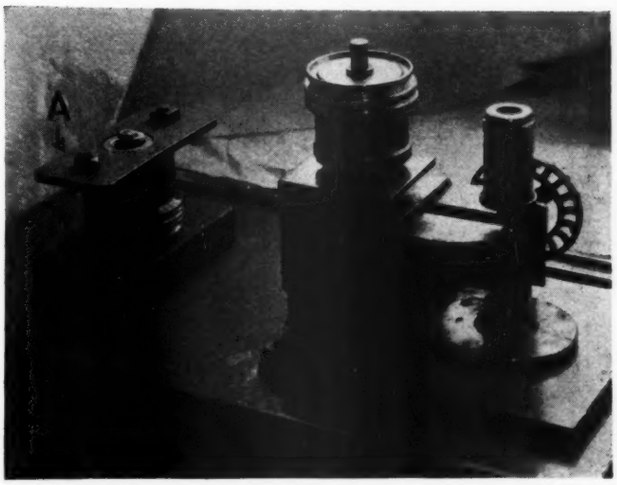


Fig. 6—Holding device for AB main piston and accelerated-release pistons.

Fig. 5—Clamping device for holding brake-cylinder piston.

Many tools and devices have been developed in this shop, and articles have been published on several occasions in the *Railway Mechanical Engineer*. Recently several other devices have been developed, all tending towards a better and more uniform method of air-brake maintenance.

Fig. 3 shows a home-made machine made with angle iron, a reciprocating part, a ⅛-hp. motor and a set of rollers. This machine is used in reclaiming the brass protector rings used in the non-pressure head of the AB brake cylinder. When these rings become worn to the extent that they are loose on the piston sleeve, they have to be renewed, then, instead of throwing away these rings, a small amount is removed from one leg of the ring, after which it is placed in the rollers and rolled until the ends again contact each other. The rings are then placed on a mandrel, shown at *A*, Fig. 3, this mandrel being of a hardened steel material on which a fine abrasive compound is applied. With the rings in place the machine is started and, with a reciprocating movement, the rings are lapped to a perfect circle and are again ready for use. However, before being again placed in service, they are gaged on a measuring device shown

at *B*, which is really a part of the piston sleeve on which these rings are used. At the end of the first year's operation, the use of this machine resulted in a substantial saving which will increase as the work increases.

Fig. 5 shows a clamping device for holding the brake-cylinder piston and compressing the release spring so that the parts in the non-pressure head can be removed for cleaning and inspection. A set of home-made tools is also shown. The ring at the upper left corner is a safety feature; it is dropped over the clamping device when the piston is in place so that the clamp will not be inadvertently released.

Fig. 6 shows a holding device for the main pistons and accelerated-release pistons of the AB valve. With the aid of these two tools, the dismantling of these two units is a simple matter. The device marked *A* is connected with a foot treadle underneath the bench and by stepping on this treadle the spring in the accelerated release piston is readily compressed so that the horse-shoe washer is removed without effort.

Fig. 8 shows the construction of two pulling devices.

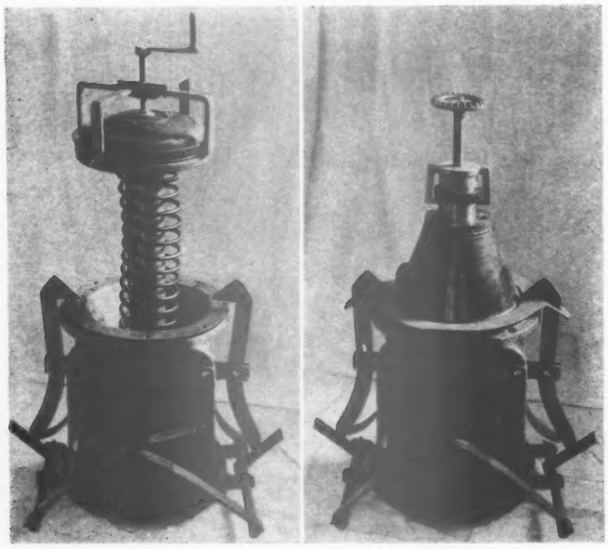


Fig. 7—How the devices for removing protector rings, packing cup and lubricating ring are used.

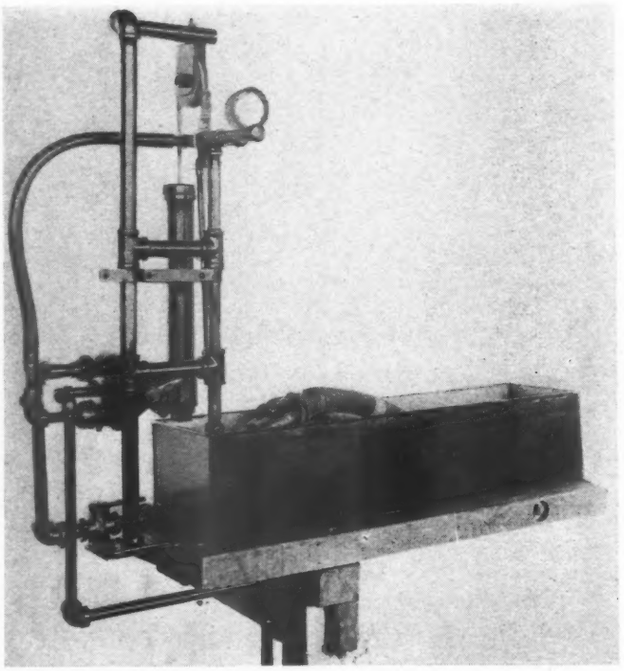


Fig. 9—Device for testing air hose after being reclaimed at Milwaukee shops.

Device *A* is used to remove the piston protector ring, and device *B* to remove the packing cup and the lubricating ring from the piston. The application of these two tools is clearly shown in Fig. 7. Much time is saved by their use and many packing cups are saved from injury in the process of removal by other methods.

Fig. 9 illustrates a device for testing air hose. All the air-hose-mounting facilities on the railroad are concentrated at Milwaukee shops. During the stripping process of old hose sent in, a visual inspection is made, and any hose appearing good are laid aside and later tested with this device. The test consists of charging the hose with air pressure and then immersing the hose and fittings completely in water. The saving resulting from this procedure is very considerable inasmuch as the salvaged hose are again placed in service on system cars.

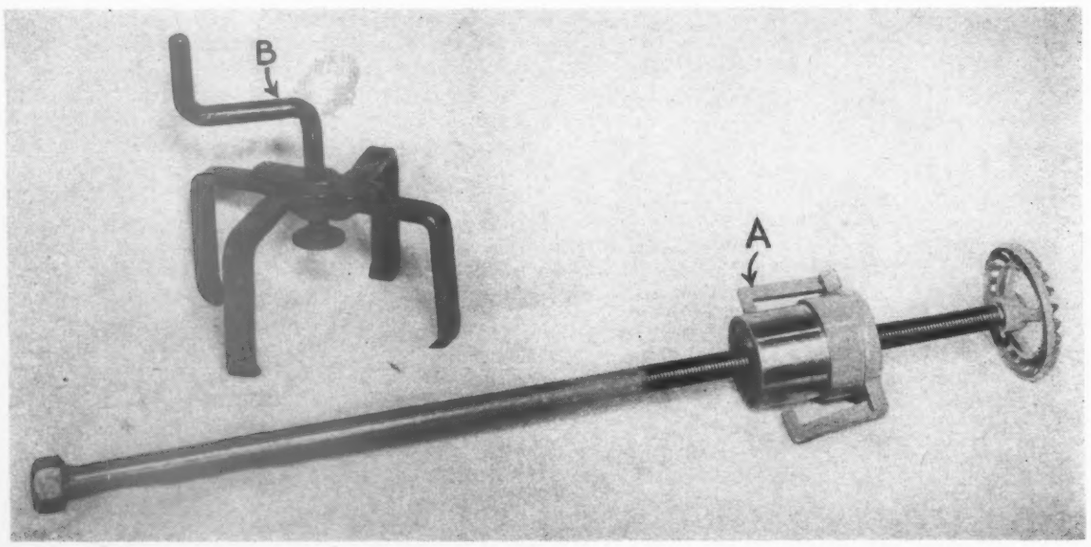


Fig. 8—Pulling devices—*A* for removing piston-protector rings and *B* for removing packing cup and lubricating ring.

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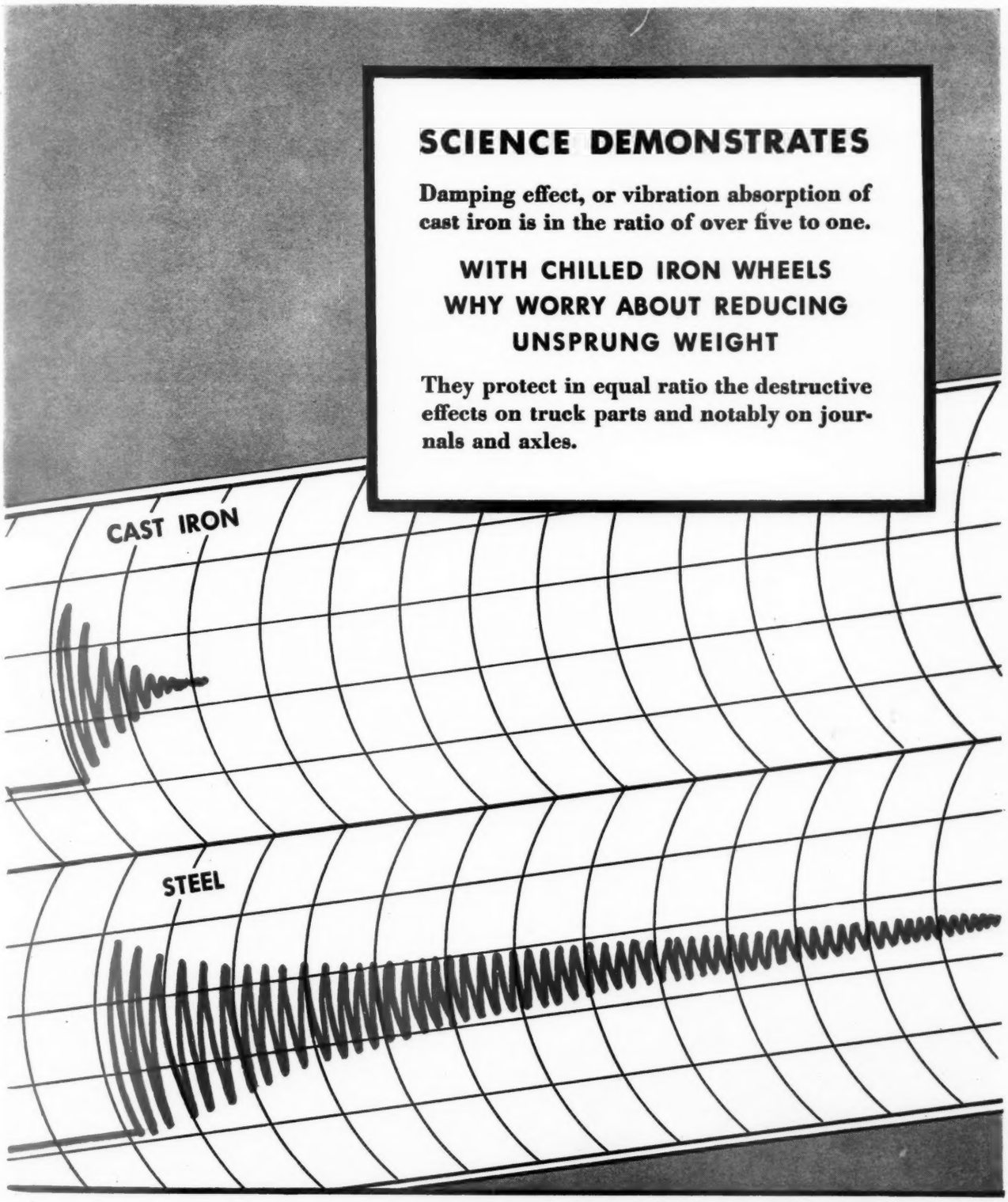
SCIENCE DEMONSTRATES
Damping effect, or vibration absorption of cast iron is in the ratio of over five to one.
WITH CHILLED IRON WHEELS WHY WORRY ABOUT REDUCING UNSPRUNG WEIGHT
They protect in equal ratio the destructive effects on truck parts and notably on journals and axles.
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Repairing Box-Car Couplers and Draft Gears

In making heavy box-car repairs at the Port Jervis, N. Y., shops of the Erie, a smoothly operating assembly-line method of production control is employed which enables the relatively small well-organized shop force to obtain production volume that would otherwise be impossible. The repair work has been broken down into various operations, each of which is performed at a certain position along the line. So that all operations are completed at the same time and the cars moved to next position, the entire work must be completely balanced.

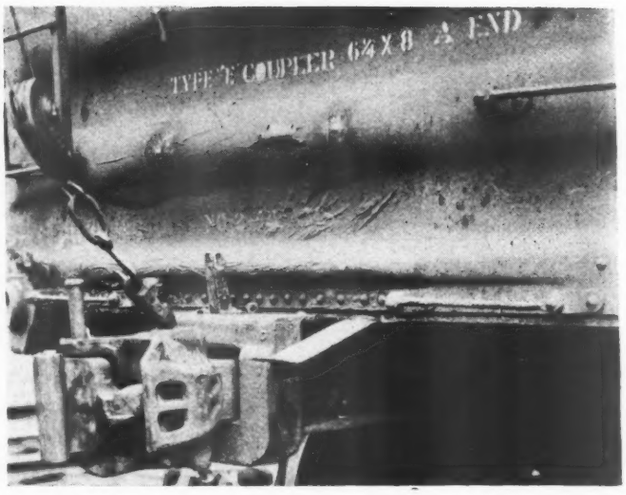
Of particular interest is the position at which the coupler and draft gears are inspected and repaired. At this spot, a simple lifting device enables the workmen to drop and raise draft gears with minimum physical effort. So that the men can work freely, the cars are raised by a locomotive crane and the trucks are moved back under the center sill. Four-inch blocking is placed on the bolster to give additional head room. The cross key and coupler are then removed with the aid of a half-ton overhead air-operated hoist.

The draft-gear device consists of a cylinder with telescoping piston mounted on wheels. This machine has an over-all height of 21 in. and a total lift of 22 in. The outside piston is 10 in. in diameter, the inside piston is 8 in. The jack was built with telescoping pistons for two reasons—to produce the required lift and for the safety of the workmen. The 8 in. piston will not exert sufficient force to lift the car off the trucks should the draft gear stick while the 10-in. piston might cause this undesirable action.

In operation, the air jack is rolled into place under the draft gear and the piston is raised until the weight of the entire draft arrangement is removed from the carrier iron. A U-shaped plate attached to the end of the 8-in. piston permits the lifting force to be applied evenly on each side of the carrier iron. The rivets securing the carrier iron to the center sill are removed and the draft arrangement is then ready for lowering with the jack. The pistons are lowered carrying the draft gear into a position where it is readily inspected and repaired if necessary.

If a draft gear is defective and requires renewal, the jack and draft gear are easily rolled from under the car into a position where the gear can be changed with the aid of the overhead air hoist. After the inspection and repair operations are completed, the air jack raises the draft gear between the sills and supports it there until the carrier iron is applied.

The draft gear is removed and applied with the portable air jack—If necessary it may be moved out from under the car



The coupler is removed by means of an overhead air-operated hoist

Air Brake Questions and Answers

D-22-A Passenger Control Valve (Continued)

615—*Q.—What test should now follow?* A.—The brake-pipe leakage test.

616—*Q.—How is this test made?* A.—Observe the pressure on the brake-pipe gage; leakage from the brake pipe will be indicated by a drop in pressure which must not exceed 2 lb. in 1 min. A slight pumping action of the emergency piston, indicated at the quick action exhaust, will not affect the leakage test.

617—*Q.—What test should follow?* A.—The auxiliary reservoir leakage test.

618—*Q.—How is this test made?* A.—If the control valve releases the brake in less than 1 min., with the device handle still in position No. 3 (lap), it indicates a leak from the auxiliary reservoir, graduating valve, slide valve, auxiliary-reservoir pipe, or a leak into the brake pipe past the test device.

619—*Q.—What test follows?* A.—The release test.

620—*Q.—How would you make this test?* A.—Move the device handle to position No. 2. The piston and slide valve of the D-22-A control valve should move to release position within 20 seconds, plus 5 seconds for each pound of brake-pipe leakage.

621—*Q.—How long should the test be continued?* A.—Until the brake cylinder pistons return to their normal release position.

622—*Q.—During this test what precaution must be observed?* A.—That the supply-line pressure does not drop below 70 lb.

623—*Q.—In case that the brake-cylinder pistons fail to return to release position, what is the probable cause?* A.—Trouble may be in the D-22-A control-valve service portion, excessive brake-rigging resistance, or trouble may be in the relay valve.

624—*Q.—How can a check be made to determine if the control valve is at fault?* A.—During the release

(*Continued on next left-hand page*)

Cut Operating Expenses . . . Increase Capacity

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Photo Courtesy Southern Pacific Company

With the increase of carloadings and the constant demand on the part of shippers for quicker deliveries, progressive railroads have found the truly economical locomotives are the new design ones. Their ability to handle heavier loads and haul them at higher speeds means a material reduction in operating expenses.

Cut your operating expenses and increase your capacity . . . with MODERN LIMA POWER.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED **INCORPORATED, LIMA, OHIO**

test, an exhaust of air at the exhaust port in the pipe bracket shows that the service piston and slide valves have returned to release position. A continuous blow at the exhaust port, however, indicates that the service portion should be removed for further investigation on the standard test rack.

A Versatile Railway Crane

The Atchison, Topeka & Santa Fe has recently installed a versatile piece of equipment in its Pawling & Harnischfeger Model 255 crawler crane, illustrated, which rolls around the Wichita, Kan., yards doing a variety of jobs.

Pawling & Harnischfeger Model 255 crawler crane, used for handling car wheels, applying steel car sides and other parts at railway shops

As the accompanying view shows, the crane serves as a useful tool in handling the various stocks of supplies arriving from time to time; piling pieces of equipment; sorting out materials; and placing needed parts in position for repair or rebuilding.

An unusually interesting use of the crane operation is found in connection with rebuilding the line's rolling stock, a considerable proportion of which consists of steel freight cars. In assembling these cars, the crane is utilized to raise the steel car sides and hold them in position for assembly. When a car is assembled, the crane loads it.

This crane maneuvers on tractor-type crawlers and should not be confused with the standard railway crane which runs on tracks. With the crawlers, the crane can travel anywhere around the yard as well as along sidings. The machine thus accomplishes a great deal of the company's loading and general handling jobs with a considerable saving in time and labor.

Mechanical Lubricator For A. A. R. Journals

The Hennessy Lubricator Co., New York, has developed a mechanical journal lubricator for use in A. A. R. journal boxes of all sizes, which can be applied without any change in the box, journal, or bearing. It can be applied or removed without removing the box from the journal. Its design permits the removal and application of the bearing without disturbing the lubricator. This lubricator dispenses with the use of waste and thereby eliminates the possibility of waste grab, allows the use of a heavier lubricant than car oil, and assures positive delivery of an ample supply of lubricant to the journal by mechanical action.

The delivery of oil to journals by capillarity when employing waste, the conventional method, requires the use of a low-viscosity oil. This means that the proper lubricant from the standpoint of viscosity for journals carrying loads such as those to which A. A. R. journals are subjected cannot be used at all times. The oil of lower viscosity delivered in this manner does not afford sufficient lubrication under certain conditions. This results in high operating temperatures which, in turn, causes the waste or other material through which the oil is fed by capillarity to become glazed or hardened with a relatively small amount of service. This may result in excessive wear and hot boxes.

The A. A. R.-type lubricator shown in the illustration is similar in operation to previous lubricators built by this company. The pump, A. A. R.-00, is actuated by the lateral movement of the journal, and forces the lubricant up to the distributor, A. A. R.-1. The felt pad, A. A. R.-3, is employed primarily to give warning in the event the journal heats in service.

The Hennessy A. A. R.-type mechanical lubricator can be applied without any change in the box, journal, or bearing and without removing the box from the journal

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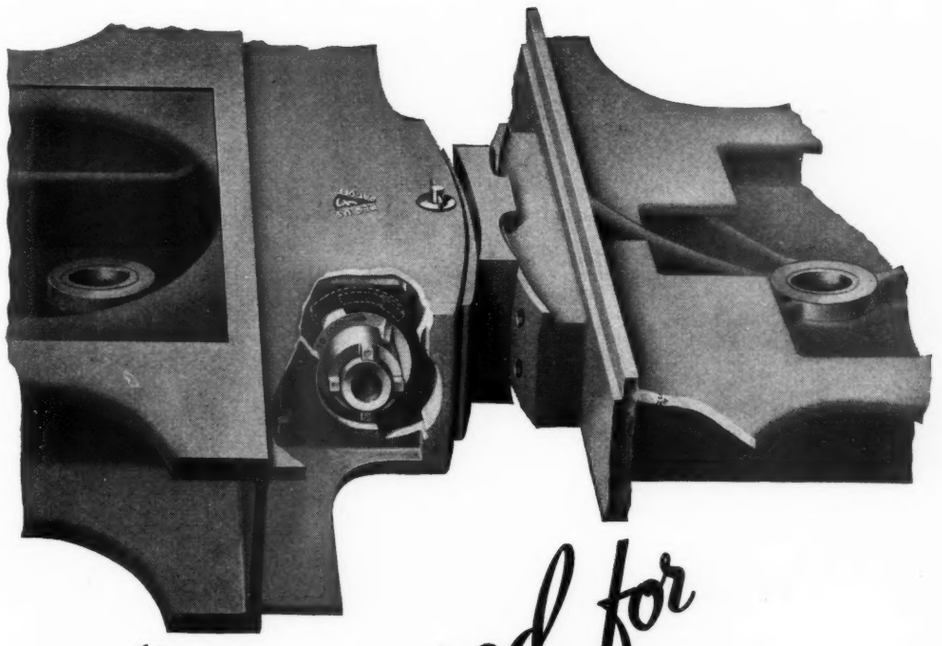

"Engineered for Easy riding"

The Type E-2 Radial Buffer makes a safer, easier riding locomotive. » » » Its spherical and cylindrical faces permit movement in any direction, while its predetermined frictional resistance dampens oscillation between engine and tender, prevents lost motion and subsequent destructive shocks to drawbar and pins. » » » Its twin, the Franklin Automatic Compensator and Snubber, takes the job of maintaining proper driving box adjustment that further improves smoothness of operation and extends locomotive mileage and reduces maintenance costs. It is particularly essential on roller bearing boxes.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK CHICAGO MONTREAL

High Spots in

Railway Affairs . . .

A. A. R. Pulls a Stunt

The annual meetings of the Association of American Railroads and its predecessors have always been closed to the public. It was therefore a distinct surprise to learn a few weeks ago that most of the sessions on November 13 and 14 would be open to the public. The speakers—several from outside the more intimate railroad family—were invited to speak frankly and they did not pull their punches. No attempt was made to whitewash the railroads and constructive criticism was the order of the day. This open-minded attitude on the part of the railroads made a distinct impression upon the visitors who attended the meetings and this was also reflected in the press reports. The experiment proved so successful, from all points of view, that it appears quite likely that it will be a feature of future meetings.

A Bit of Sound Philosophy

"I like to think of a railroad," said E. E. Norris, president of the Southern Railway, "not as an aggregate of inanimate locomotives and cars and tracks and buildings, but as a virile army of men and women working together to provide an essential service. I like to think of a railroad in terms of human activity, rather than in terms of physical property. For there would be no railroad plant to begin with, had it not been for the dreams, the courage, the skill, and the labor of millions of human beings. Nor could all the locomotives and cars in the world turn a wheel without co-ordinated human effort, ranging all the way from the mental work of planning and direction to the physical work of actual operation and maintenance. Fundamentally therefore the railroad is a human thing. From this concept of a railroad stems the thought that the improvement of railroad service must concern, first of all, the men and women who comprise the railroad family. That means the fellows at the top, those at the bottom, and all those in between. That means that the starting point for improvement in railroad service must lie in the minds of railroad people—in their attitudes; their mental processes; and their resulting actions. That means that if we really want to improve railroad services we've first got to improve our will and our capacity to please." Near the close of Mr. Norris' address, which was made at the annual meeting of the Association of American Railroads, he said, "in my opinion we must begin the improvement of our services at home; by erasing the last trace of the monopoly-mind from our thinking and our actions; and by inspiring, in its stead, that priceless thing—genuine friendliness—which warms the heart of both the giver and the receiver. It can be done. It is being done."

What Research Has Done for Passenger Service

"The performance of the present quality of passenger service at a lower rate than in 1916, notwithstanding greatly increased costs, is truly a modern miracle resulting from continual research," said C. E. Smith, vice-president of the New York, New Haven & Hartford, in an address on Railroads and Research before the annual meeting of the Association of American Railroads. "Comparing passenger service now rendered at a basic rate of two cents per mile, with the period when it was formerly rendered at two cents per mile," said Mr. Smith, "we find the passenger cars which then cost $8,000 each now cost from $40,000 to $70,000 each. Locomotives which cost then $15,000 to $20,000 now cost $100,000 to $500,000; wages have more than doubled, from an average of 28.3 cents per hour in 1916 to over 75 cents per hour in 1939; from an average of $891.61 annual wage in 1916 to $1,886.59 in 1939; trains are operated at greatly increased speeds with greater safety and with much greater comfort. The average revenue per passenger-mile in 1916 was 2.042 cents, as compared to 1.839 cents in 1939. In 1916 passenger cars were poorly lighted and heated and lacking in convenience and comfort. Today, as a result of continuous research we have de luxe, all-metal cars, well lighted, with temperature and air controlled winter and summer, and with more convenience and comfort than most modern homes."

Shippers Proud Of Railroads

J. E. Bryan, president of the National Industrial Traffic League, in speaking from the shippers' point of view at the meeting of the Association of American Railroads, frankly declared that "the shippers as a whole are proud of their railroad systems." While the shippers may oppose the railroads in the matter of rates, rules and regulations, they realize that they are still largely dependent upon them for the successful operation of their own business. Mr. Bryan suggested that instead of attempting to build from the top down, the railroads should build from the bottom up, by trying to get back the less-than-carload traffic through the medium of better service. "Frankly," he said, "I do not believe that there has been enough concerted effort on the part of the carriers to take back that merchandise traffic, most of which goes at the higher class rates and is remunerative." He felt also that "special attention should be given to branch line service. There is a wealth of it available," he said. "The Diesel engine, with its rubber tires, for auxiliary service of some kind, should be added to bring that tonnage down to the main line of the railroad and expedite it to the terminals and out again to wherever it belongs."

How to Make Railroad Jobs

"If the responsible heads of the Railroad Brotherhoods will call a truce on all efforts to create unwarranted jobs and working conditions and will unite with management in a concerted and vigorous effort not only to retain to the rails the traffic which now moves over them, but, as well, to get their full share of any expansion of business, they will undoubtedly be doing more to create additional jobs and heavier pay envelopes than can be accomplished in any other way." This is a rather long sentence, but it surely contains a world of truth. Moreover, it is of special importance in this country at this time, when we must put forth every effort in building up our national defense program and at the same time take care of the needs of our people. The quotation is taken from an address made by Jacob Aronson, vice-president, law, New York Central System, at the recent annual meeting of the Association of American Railroads.

The Heart of The Railroad Plant

In speaking from the viewpoint of an operating man at the meeting of the Association of American Railroads on November 14, R. H. Smith, vice-president and general manager of the Norfolk & Western, pointed out the really remarkable improvement that has been made in the railroad plant during the past two decades. "The heart of the railroad plant," he said, "is the locomotive, and that properly is where the great improvement has been made. The 1939 locomotive was stronger in drawbar pull than the 1920 engine and was also speedier. The 1939 freight train, in addition to being heavier than the 1920 train, was run faster, so that for each hour of road work, the present-day locomotive is developing twice the transportation service of its 1920 counterpart." This record, he pointed out, is made in spite of the fact that some of the older locomotives are still retained in service. "The 1939 locomotive, with its much greater availability and working hours," he said, "is developing several times the actual transportation of its 1920 predecessor and it is doing this much cheaper, in spite of rising wage costs."

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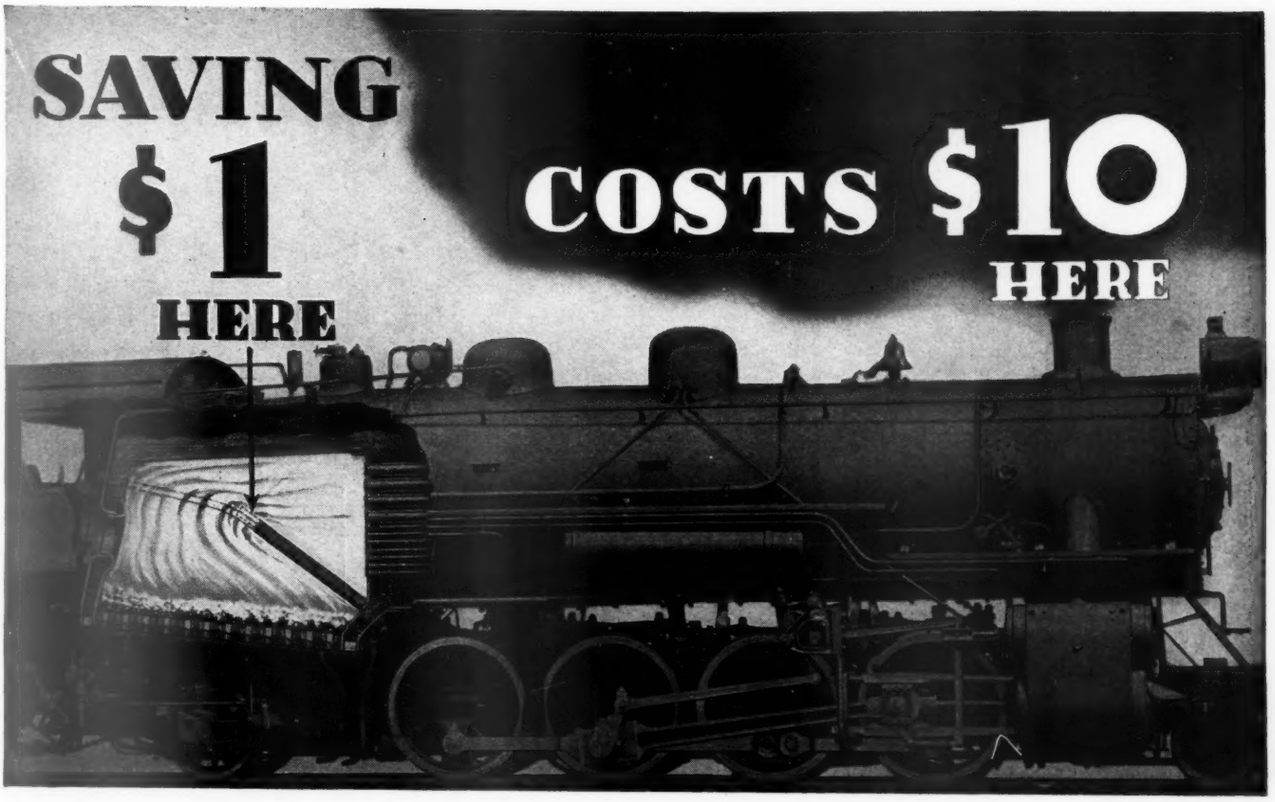

cut down on the arch and you boost the fuel bill

No one questions locomotive Arch economy. The Arch has been so thoroughly proved as a fuel saver by railroad after railroad for years past.

In the urge for money saving don't let the desire to save a few dollars in Arch brick expense by skimping on the Arch blind you to the fact that every dollar thus "saved", boosts the fuel bill ten dollars.

The surest way to the lowest operating cost is not in crippling proved economy devices but in making full use of them. This means complete Arches, with every brick in place, for each locomotive that leaves the roundhouse.

HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists

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60 EAST 42nd STREET, NEW YORK, N. Y.

Locomotive Combustion Specialists

Among the Clubs and Associations

RAILWAY CLUB OF PITTSBURGH.—Meeting held on November 21 at Fort Pitt Hotel, Pittsburgh, Pa. Speaker: A. F. Stuebing, development engineer, Carnegie-Illinois Steel Corporation. Subject: High-Tensile Steels in Railroad Service, supplemented by moving pictures, "Making and Shaping of Steel."

NORTHWEST LOCOMOTIVE ASSOCIATION.—Meeting 8 p. m., December 16, at Woodruff Hall, St. Paul, Minn. Speaker: L. E. Caldwell, service education director, Electro-Motive Corporation. Subject: Modern Diesel Locomotives, with motion pictures entitled "EMC Railway Type Diesel Engines" and "Diesels Working on the Railroads."

NEW YORK RAILROAD CLUB.—Sixty-eighth anniversary dinner, Commodore hotel, New York, Thursday, December 12, at 7 p. m. W. E. Corrigan, vice-president American Locomotive Company, New York, is general chairman. Reservations should be placed with C. C. Fletcher, chairman, seating committee, Room 1462, 460 Lexington Ave., New York, by December 2.

PURCHASES AND STORES DIVISION, A. A. R.—Twenty-three committees with approximately 180 members have been selected to prepare reports for the next annual convention of the Purchases and Stores division, A. A. R. These committees are exclusive of the General, Advisory and Special Purchasing committees of the Division and its regional purchasing and stores committees. One new committee has been formed to study Diesel-engine parts, and committee work on highway vehicles, shop-made materials, fire and safety and terminal railway storekeeping has been revised. The personnel of the new standing committees includes 4 new chairmen and 17 new members. A. C. Mann, vice-president, Illinois Central, is chairman of the Division.

Some of the subject committees and their chairmen are as follows:

Purchasing and Stores Manual: P. L. Grammer, assistant purchasing agent, Penna.
Material Classification: E. G. Roberts, general storekeeper, C. R. I. & P.
Railroad Scrap: R. E. Hamilton, supervisor reclamation, C. & O.
General Reclamation (Joint with Mechanical and Engineering Divisions): E. R. Casey, superintendent of reclamation, U. P.
Shop Made Materials: G. D. Tombs, division storekeeper, I. C.
Fuel: P. A. Hollar, fuel purchasing agent, Penna.
Fire and Safety: H. J. Blum, general storekeeper, M-K-T.
Handling Facilities: S. P. Warmack, general storekeeper, I.-G. N.
Simplification and Standardization: A. G. Follette, general material supervisor, Penna.
Stores Practices and Records: J. S. Genther, general storekeeper, L. & N. E.
Marking Tools, Materials, Etc.: W. H. Lloyd, division storekeeper, C. R. I. & P.
Diesel Engine Parts: O. L. Browne, assistant to purchasing agent, A. C. L.

NEW ENGLAND RAILROAD CLUB.—Meeting December 11 (one day later than regular meeting) at Hotel Touraine, Boston, Mass. Address by Joseph B. Eastman, chairman, Interstate Commerce Commission. Meeting starts with dinner at 6:30 p. m.

COMMITTEE OF THE COORDINATED ASSOCIATIONS.—At a meeting of the Committee of the Coordinated Associations at the close of the annual meetings of the Railway Fuel and Traveling Engineers' Association, the Master Boiler Makers' Association, the Car Department Officers' Association, and the Locomotive Maintenance Officers' Association, and the exhibit of the Allied Railway Supply Association, the dates for next year's simultaneous meetings were established as September 22, 23, and 24, 1941. They will be held without the exhibit.

DIRECTORY

The following list gives names of secretaries, dates of next regular meetings, and places of meetings of mechanical associations and railroad clubs:

AIR BRAKE ASSOCIATION.—R. P. Ives, Westinghouse Air Brake Company, 3400 Empire State building, New York.

ALLIED RAILWAY SUPPLY ASSOCIATION. — J. F. Gettrust, P. O. Box 5522, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—C. E. Davies, 29 West Thirty-ninth street, New York.
RAILROAD DIVISION.—C. L. Combes, *Railway Mechanical Engineer*, 30 Church street, New York City.
MACHINE SHOP PRACTICE DIVISION.—Warner Seely, Warner & Swasey Co., 5701 Carnegie avenue, Cleveland, Ohio.
MATERIALS HANDLING DIVISION. — F. J. Shepard, Jr., Lewis-Shepard Co., Watertown Station, Boston, Mass.
OIL AND GAS POWER DIVISION. — W. J. Hargest, American Machinst, 330 West Forty-second street, New York.
FUELS DIVISION.—A. R. Mumford, Consolidated Edison Co., 4 Irving Place, New York.

ASSOCIATION OF AMERICAN RAILROADS.—Charles H. Buford, vice-president Operations and Maintenance Department, Transportation Building, Washington, D. C.
OPERATING SECTION. — J. C. Caviston, 30 Vesey street, New York.
MECHANICAL DIVISION.—V. R. Hawthorne, 59 East Van Buren street, Chicago.
PURCHASES AND STORES DIVISION.—W. J. Farrell, 30 Vesey street, New York.
MOTOR TRANSPORT DIVISION. — George M. Campbell, Transportation Building, Washington, D. C.

CANADIAN RAILWAY CLUB. — C. R. Crook, 4415 Marcil avenue, N. D. G., Montreal, Que. regular meetings, second Monday of each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT ASSOCIATION OF ST. LOUIS. — J. J. Sheehan, 1101 Missouri Pacific Bldg., St. Louis, Mo. Regular monthly meetings third Tuesday of each month, except June, July and August, DeSoto Hotel, St. Louis, Mo.

CAR DEPARTMENT OFFICERS' ASSOCIATION.—Frank Kartheiser, chief clerk, Mechanical Dept., C. B. & Q., Chicago. Annual meeting September 22, 23 and 24, 1941.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 8238 S. Campbell avenue, Chicago. Regular meetings, second Monday in each month, except June, July and August, La Salle Hotel, Chicago.

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—H. E. Moran, Chicago Great Western, Council Bluffs, Ia. Regular meetings, second Thursday of each month.

CENTRAL RAILWAY CLUB OF BUFFALO.—Mrs. M. D. Reed, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meetings, second Thursday of each month, except June, July and August, at Hotel Statler, Buffalo.

EASTERN CAR FOREMEN'S ASSOCIATION. — Roy MacLeod, Room 127, General Office Bldg., N. Y., N. H. & H., New Haven, Conn. Regular meetings, second Friday of January, February, March, April and October at Engineering Societies Bldg., 29 West Thirty-ninth street, New York.

INDIANAPOLIS CAR INSPECTION ASSOCIATION. — R. A. Singleton, 822 Big Four Building, Indianapolis, Ind. Regular meetings, first Monday of each month, except July, August and September, in Indianapolis Union Station, Indianapolis, at 7 p. m.

INTERNATIONAL RAILWAY FUEL ASSOCIATION. — See Railway Fuel and Traveling Engineers' Association.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—See Locomotive Maintenance Officers' Association.

LOCOMOTIVE MAINTENANCE OFFICERS' ASSOCIATION.—J. E. Goodwin, general foreman, locomotive department Missouri Pacific, North Little Rock, Ark. Meeting September 22, 23 and 24, 1941.

MASTER BOILER MAKERS' ASSOCIATION. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y. Annual meeting September 22, 23 and 24, 1941.

NEW ENGLAND RAILROAD CLUB. — W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meetings, second Tuesday in each month, except June, July, August and September.

NEW YORK RAILROAD CLUB.—D. W. Pye, Room 527, 30 Church street, New York. Meetings, third Thursday in each month, except June, July, August, September and December at 29 West Thirty-ninth street, New York.

NORTHWEST CAR MEN'S ASSOCIATION. — E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meetings, first Monday each month, except June, July and August, at Midway Club rooms, 1931 University avenue, St. Paul.

NORTHWEST LOCOMOTIVE ASSOCIATION. — G. F. Greenleaf, chief clerk to mechanical engineer, Northern Pacific, St. Paul, Minn. Meeting last Monday of each month, except June, July and August.

PACIFIC RAILWAY CLUB. — William S. Wollner, P. O. Box 3275, San Francisco, Cal. Monthly meetings alternately in northern and southern California.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1647 Oliver Building, Pittsburgh, Pa. Regular meetings, fourth Thursday in month, except June, July and August, Fort Pitt Hotel, Pittsburgh, Pa.

RAILWAY FUEL AND TRAVELING ENGINEERS' ASSOCIATION.—T. Duff Smith, Room 811, Utilities building, 327 South La Salle street, Chicago. Annual meeting, September 22, 23 and 24, 1941.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION. —J. D. Conway, 1941 Oliver Building, Pittsburgh, Pa.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings, third Thursday in January, March, May, July and September. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

TORONTO RAILWAY CLUB.—D. M. George, Box 8, Terminal A, Toronto, Ont. Meetings, fourth Monday of each month, except June, July and August, at Royal York Hotel, Toronto, Ont.

TRAVELING ENGINEERS' ASSOCIATION.—See Railway Fuel and Traveling Engineers' Association.

VALLEY ANTHRACITE CAR FOREMEN'S ASSN.—Exec. sec., Walter B. Riggin, 215 Swartz st., Dunmore, Pa. Meets third Monday of each month at Wilkes-Barre, Pa.

WESTERN RAILWAY CLUB.—W. L. Fox, executive secretary, Room 822, 310 South Michigan avenue, Chicago. Regular meetings, third Monday in each month, except June, July, August and September.

(*Turn to next left-hand page*)

THERE GO 2000 MORE STEEL WHEELS!

HERE are the first of 250 new freight cars recently placed in service by the Denver and Rio Grande Western. These cars, of 50-ton capacity, are modern in every respect, built with U·S·S Cor-Ten, and equipped for low-cost, long-mileage operation with U·S·S One-Wear Wrought Steel Wheels.

Started only a few years ago, the trend toward steel wheels is rapidly assuming the proportions of a landslide. More than a million one-wear steel wheels are in service today—and every day the number is increasing. New freight cars are rolling out of the shops on steel wheels. Railroads and private car-line operators are replacing defective wheels with steel.

Why? Because the steel wheel offers longer mileage, lower service costs, lighter weight, and greater safety. Experience has proved these advantages so convincingly that no railroad can afford to overlook them. Send today for data.

Don't pass up these Savings

1. LONG MILEAGE. Mileages up to 300,000 miles have been recorded for one-wear steel wheels. Conservatively, this wheel generally averages at least 180,000 miles under 50/55 ton equipment.

2. LOW COST. Years of actual service with these wheels prove they cost less, per thousand miles, than any other type of freight car wheel.

3. SAVE WEIGHT. These wheels save 1400 pounds per car, adding extra lading capacity, reducing unsprung weight 12%, reducing roadway depreciation.

4. GREATER SAFETY. A.A.R. records prove that derailments and delays due to wheels decline sharply wherever steel wheels are used.

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh — *Chicago*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Export Company, New York

UNITED STATES STEEL

NEWS

Boiler Explosion on F.E.C. Causes Death of Head-End Crew

EXPLOSION of the boiler of the locomotive hauling Florida East Coast passenger train No. 34, the northbound "Tamiami," four miles south of New Smyrna Beach, Fla., late on October 25, caused the derailment of the locomotive in which the fireman and engineman sustained injuries resulting later in death. No passengers suffered serious injuries. Investigation developed that the explosion was due to low water.

A. A. R. Holds First Open Meeting

OVER 800 persons, including railroad officers, traffic managers, and representatives of industry, agriculture and labor, gathered at the Biltmore Hotel, New York, on November 13 and 14, for the first open meeting ever held by the Association of American Railroads. Distinguished leaders in finance, government, agriculture and industrial traffic management discussed railroad questions from their respective points of view at the open session on Wednesday morning, November 13, and at the banquet in the evening, while on Thursday morning a panel of representatives of shippers, labor and carriers held a symposium on railroad service and how it may be further improved.

The annual dinner of the Railway Business Association on Thursday evening afforded an opportunity for another get-together of many of those who had attended the A. A. R. meeting. Because of the open meeting of the A. A. R., there were no addresses at the R. B. A. dinner.

Car Service Division Report

THE increase in serviceable equipment as compared with last year and the continuing cooperation of shippers in the matter of efficient car utilization are expected by the Car Service Division to result in a meeting of this fall's equipment needs satisfactorily. This assurance is given in the Division's annual report which is now being distributed.

In another place the report lays considerable stress on the economies which come from heavier loading of cars. The new high mark of 36.8 tons set in 1939 as the average tons per car of carload freight is cited; and the report goes on to observe that if the average load last year had remained at the 1938 level "it would have required 652,000 more car loads to have handled the traffic." Moreover the improved loading during the October, 1939, peak "was equivalent to adding 20,000 cars to the equipment supply without capital cost." The report added: "Perhaps no single factor today—with all operating procedure under studied control—presents so definite an opportunity for reduction in expense as does this item of heavier loading."

The report recalls how the Division's Troop Movement Section was reorganized on August 1 as the Military Transportation Section with enlarged duties and an increase in personnel. During the year ended September 1, the Military Transportation Section furnished routings for the movement of more than a quarter of a million men for the army, navy, marine corps and C. C. C., exclusive of the men handled in the fall maneuvers of the four armies. While there is no measure of the amount of revenue returned to the carriers as a result of movements of the military, the railroads have thus far earned a gross of $120,998,000 from C. C. C. freight and passenger movements.

The discussion of the automobile car situation points out that "the number of machines delivered overland and shipped by boat accounted for 61.6 per cent of the 1939 United States production, which was the largest proportion of the production handled by these agencies during any calendar year on record." Meanwhile "there has been no shortage of device-equipped automobile cars for the handling of all the commercial shipments offered by the industry." Nor has there been any difficulty in taking care of all requirements for refrigerator cars.

Lehigh Valley Apprentices Honored

AN unusual event took place on the Lehigh Valley at Sayre, Pa., on Saturday evening, November 2. The great Shops Assembly Hall was filled with almost 1,200 people, who participated in a banquet and entertainment given by the Sayre System Shop Athletic Association in honor of the 119 Lehigh Valley Shop apprentices. The toastmaster was Harry J. Farr, and the principal address was made by President A. N. Williams of the Lehigh Valley, who was introduced by Dr. Donald Guthrie, the chief surgeon of the road. President Williams commended the good work being done by the apprentices. He also discussed certain phases of the national defense program which involve carrier co-operation. Short talks were also made by Dexter C. Buell of the Railway Educational Bureau; Roy V. Wright, editor of the *Railway Mechanical Engineer;* Judge R. W. Barrett, vice-president and general counsel of the Lehigh Valley; John Duffy, vice-president of traffic; and Ernest G. Smith, a member of the board of directors of the Lehigh Valley. A unique feature of the program was a series of lantern slides showing the status and school and work percentage records for a number of the more advanced apprentices. Dinner music was furnished by the Lehigh Valley System Shops Band. In addition to those mentioned, a number of other executive officers of the railroad were present.

City of Los Angeles Has Coach-Lounge

A COACH-lounge, an innovation in passenger service, has recently been added to the Streamliner City of Los Angeles of the Union Pacific-Chicago & North Western. The addition increases the consist of the train to 18 cars. The new car has 24 reclining coach seats in the forward half and an array of settees and lounge chairs upholstered in green, brown and blue in the other half. The walls and the ceilings are colored with combinations of chartreuse, gray, ivory and light cream.

Budd Analysis of Florida Streamliner Business

SUPPLEMENTING an analysis of the possibilities of streamline trains throughout the country published last Spring, the Edward G. Budd Manufacturing Company has issued a 100-page volume of the same character describing the operations and traffic results of streamliners to and within Florida which the Seaboard Air Line, Atlantic Coast Line and Florida East Coast have placed in service since February, 1939.

For each of the three railroads there is presented a brief pictorial history, scenes of the new passenger equipment and of inaugural celebrations and a complete set of floor plans.

Locomotive Orders—A Correction

FOOTNOTE 3 in the table of Orders and Inquiries for New Equipment on page 426 of the October, 1940, issue applies to two orders. The eight locomotives purchased by the D. M. & I. R. from the Baldwin Locomotive Works have a total value of approximately $2,000,000. The Seaboard Air Line 2,000-hp. Diesel-electric locomotive which was on display at the New York World's Fair this year is for use with the Silver Meteor equipment between New York and Florida.

Book on Railways and Supply Industry Prepared by R. B. A.

A NEW book, Railways and the Equipment and Supply Industry was prepared by the Railway Business Association, Chicago, for its annual meeting at New York on November 14. The 100-page brochure is a compilation of historical and other

data relating to the facilities and equipment used on the railways. The subjects include Roadbed, Tunnels and Bridges; Rails and Signals; The American Locomotive; The Car Builders; and The Railway and the Laboratory. A list of officers and members of the R. B. A. is also included.

The book is written "as a tribute to all the scientists, inventors and engineers who have had a share in creating a great transportation machine and to others who have built an important industry whose laboratories and plants produce and assemble the thousands of parts from which this machine is constructed."

In the various chapters of the book it is pointed out that the coming years promise to see the emergence of the type of locomotive power which can do the work best and cheapest, and as to speeds, the limiting factors now are the track and the roadbed rather than the type—Diesel or steam.

Improvements in railway travel and in the handling of the freight traffic of American railways are due just as much to the progressive adaptation of the vehicle to the changing requirements of today as to the constantly increasing improvements in the track and in the motive power.

While distinct and separate capital investment exists as between the railways and the railway equipment and supply industry, there is an indissoluble partnership that binds together these two fields of American private enterprise in the common interest of the public and in the perfection of the rail transport machine.

Equipment Purchasing and Modernization Programs

Atchison, Topeka & Santa Fe.—The Santa Fe has asked the Interstate Commerce Commission for authority to assume liability for $10,000,000 of 1¼ per cent equipment trust certificates, maturing serially in the sum of $1,000,000 on December 5, 1941, and a like amount annually thereafter, until and including December 5, 1950. The proceeds will constitute 80 per cent of the purchase price of new equipment costing a total of $12,500,000 and consisting of 2,000 50-ton box cars; 300 70-ton ballast cars; 200 50-ton low-side gondola cars; 50 70-ton low-side gondola cars; one baggage car; one baggage-mail car; 14 chair cars, one lunch-counter diner; two club lounge cars; one chair observation car; eight oil-burning passenger steam locomotives without tenders, with conventional main and side rods; two oil-burning passenger steam locomotives without tenders, with main and side rods of high dynamic steel and side rods, equipped with roller bearings on all crank pins; 10 locomotive tenders, and three Diesel-electric locomotives of 2,000 hp. each.

Bessemer & Lake Erie.—The B. & L. E. has asked the Interstate Commerce Commission for authority to assume liability for $4,000,000 of equipment trust certificates, maturing in 10 equal annual installments of $400,000 on December 16, in each of the years from 1941 to 1950, inclusive. The proceeds will constitute a

(*Continued on second left-hand page*)

Orders and Inquiries for New Equipment Placed Since the Closing of the November Issue

Locomotive Orders

Road	No. of Locos.	Type of Locos.	Builder
Atchison, Topeka & Santa Fe	1	4,000-hp. Diesel-elec	Electro-Motive Corp.
	1	4,000-hp. Diesel-elec	American Loco. Co.
Brazilian and Bolivian Govt's	4	Mogul type	Vulcan Iron Works
Chicago, Rock Island and Pacific	2[1]	2,000-hp. Diesel-elec.	American Loco. Co.
	2[1]	1,000-hp. Diesel-elec.	
Florida East Coast	1	2,000-hp. Diesel-elec.	Electro-Motive Corp.
Kansas City Terminal	2	1,000-hp. Diesel-elec.	American Loco. Co.
	1	660-hp. Diesel-elec.	
Ministry of Transp. and Public Works, Brazil	13	2-8-2	American Loco. Co.
	10	2-8-2	Baldwin Loco. Works
	3	2-6-6-2	
Newburgh & South Shore	1[2]	1,000-hp. Diesel-elec.	American Loco. Co.
Spokane, Portland & Seattle	2[2]	1,000-hp. Diesel-elec.	American Loco. Co.
	2[2]	1,000-hp. Diesel-elec.	Baldwin Loco. Works
Terminal Rwy., Alabama State Docks	1	0-6-0	American Loco. Co.
Union Railroad	2[2]	1,000-hp. Diesel-elec.	Baldwin Loco. Works
Wyandotte Terminal	1	300-hp. Diesel-elec.	General Electric Co.

Locomotive Inquiries

Seaboard Air Line	2	600-hp. Diesel-elec.	.....
Texas Pacific-Missouri Pacific-Terminal R. R. of New Orleans	1	660-hp. Diesel-elec.	.....

Freight-Car Orders

Road	No. of Cars	Type of Cars	Builder
Atchison, Topeka & Santa Fe	300	Ballast	Rodger Ballast Car Co.
	250	Gondola	Gen. Amer. Transp. Corp.
	200	Hopper	
	50	Flat	
	2,000	Box	Pull. Std. Car Mfg. Co.
Canadian General Transit Co., Ltd.	1[3]	Tank	Canadian Car & Fdry Co.
Chicago, West Pullman & Southern	2	50-ton gondola	Company shops
Denver & Rio Grande Western	28	Freight	Company shops
	500	50-ton box	Pressed Steel Car Co.
E. I. du Pont de Nemours & Co.	2	50-ton tank	American Car & Fdry. Co.
Electro Bleaching Gas Co.	1[3]	40-ton tank	American Car & Fdry Co.
Erie	250	Hopper	Pull. Std. Car Mfg. Co.
	250	Hopper	Gen. Amer. Transp. Corp.
	200	Box	American Car & Fdry. Co.
	100	Box	Magor Car Co.
	250	Gondola	Greenville Steel Car Co.
	100	Furniture	American Car & Fdry. Co.
Hooker Electrochemical Co.	5	40-ton tank	Gen. Amer. Transp. Corp.
Lehigh & New England	300	Hopper	Pressed Steel Car Co.
Monsanto Chemical Co.	6	50-ton tank	Gen. Amer. Transp. Corp.
	3	40-ton tank	
New York Central	1,000	50-ton box	Despatch Shops, Inc.
North Western Refrigerator Line Co.	100[2]	40-ton refrigerator	American Car & Fdry. Co.
	100[2]	50-ton refrigerator	
U. S. Army, Corps of Engineers	20	Box	Gen. Amer. Transp. Corp.
	4	Flat	Haffner-Thrall Car Co.
U. S. Navy	15	50-ton flat	American Car & Fdry. Co.
	6	Gondola	Haffner-Thrall Car Co.
	5	50-ton flat	
	3	50-ton box	
War Dept., Office of Chief Engineer	260	Tank	American Car & Fdry. Co.

Freight-Car Inquiries

Road	No. of Cars	Type of Cars	Builder
Duluth, Missabe & Iron Range	30	Ballast	.....
Elgin, Joliet & Eastern	500	Gondola	.....
	250	Hopper	.....
Erie	70	Caboose	.....
Louisville & Nashville	3,000	Hopper	.....
	100	Automobile	.....
	50	Gondola	.....
Norfolk Southern	250	40-ton box	.....
	50	50-ton hopper	.....
	50	50-ton gondola	.....
Seaboard Air Line	700	Freight	.....

Passenger-Car Orders

Road	No. of Cars	Type of Cars	Builder
Atchison, Topeka & Santa Fe	14	Chair	Edw. G. Budd Mfg. Co.
	2	Club-lounge	
	1	Chair-observation	
	1	Lunch counter diner	
	1	Mail-storage	
	1	Baggage-mail	
Chicago, North Shore & Milwaukee	8[3]	.....	St. Louis Car Co.

[1] Purchase authorized by the federal district court. Those of 2,000 hp. each will be used on the Arizona Limited, an all-Pullman streamlined train which the Rock Island and the Southern Pacific will place in service between Chicago and Phoenix, Ariz., on December 15, and those of 1,000 hp. each will be used in mixed train service on the branch line between Albert Lea, Minn., and Sioux Falls, S. D., via Estherville, Iowa.

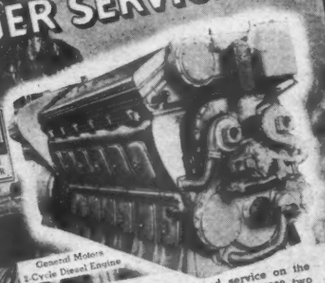
[2] Delivery received.

[3] Two articulated passenger-trains of four units each, including coaches and tavern car.

Stellar Per

99% Availability

SIX B.&O. DIESELS OPERATE 3,441,916 MILES IN PASSENGER SERVICE



General Motors 2-Cycle Diesel Engine

SIX 3600 Hp. EMC Diesel passenger locomotives entered service on the Baltimore and Ohio—two in May and June, 1937, two in January, 1938, two in June, 1938. Up to June 30, 1940, these locomotives have operated 3,441,916 miles with an average availability of 95.5 per cent. Diesel locomotive No. 56 on the Capitol Limited, which operated every day for an entire year without missing a trip, has to its credit 515,485 miles with 99.3 per cent availability.

Typical of EMC Diesel performance, these records are being made in fast passenger service without excessive top speeds but with high average speed consistent with safety, passenger comfort, and minimum wear on rolling stock and track. No other type of motive power can equal this performance.

ELECTRO-MOTIVE CORPORATION

B&O

99.23% Availability

Six Rockets Make Records

The Rock Island's fleet of six smartly styled stainless steel streamlined "Rockets" has established an enviable performance record with the utmost in safety, comfort and economy.

The six "Rocket" locomotives, built by Electro-Motive Corporation and each powered by one General Motors 1200 horsepower two-cycle Diesel engine, entered service in the fall of 1937. The records shown are from the date of installation to January 1, 1940.

Entered Service in Fall of 1937

2,986,317 Total Miles Operated

99.23% Average Availability

$.08 Average Maintenance Cost per Mile

28 MONTHS Average Time in Service

112,299 Average Assigned Miles per Month

Rock Island ROCKETS

ELECTRO-MOTIVE CORPORATION

Railway

NORTHWE

erformances

BACK of the name **"EMC DIESEL"** stands irrefutable evidence of superior performance. Not by one locomotive but many—not on one railroad but many.

EMC Diesel locomotives, operating in the world's fastest schedules and with highest mileages per day and year, continue to establish records for low operating costs, dependability and high availability — far above any other type of motive power.

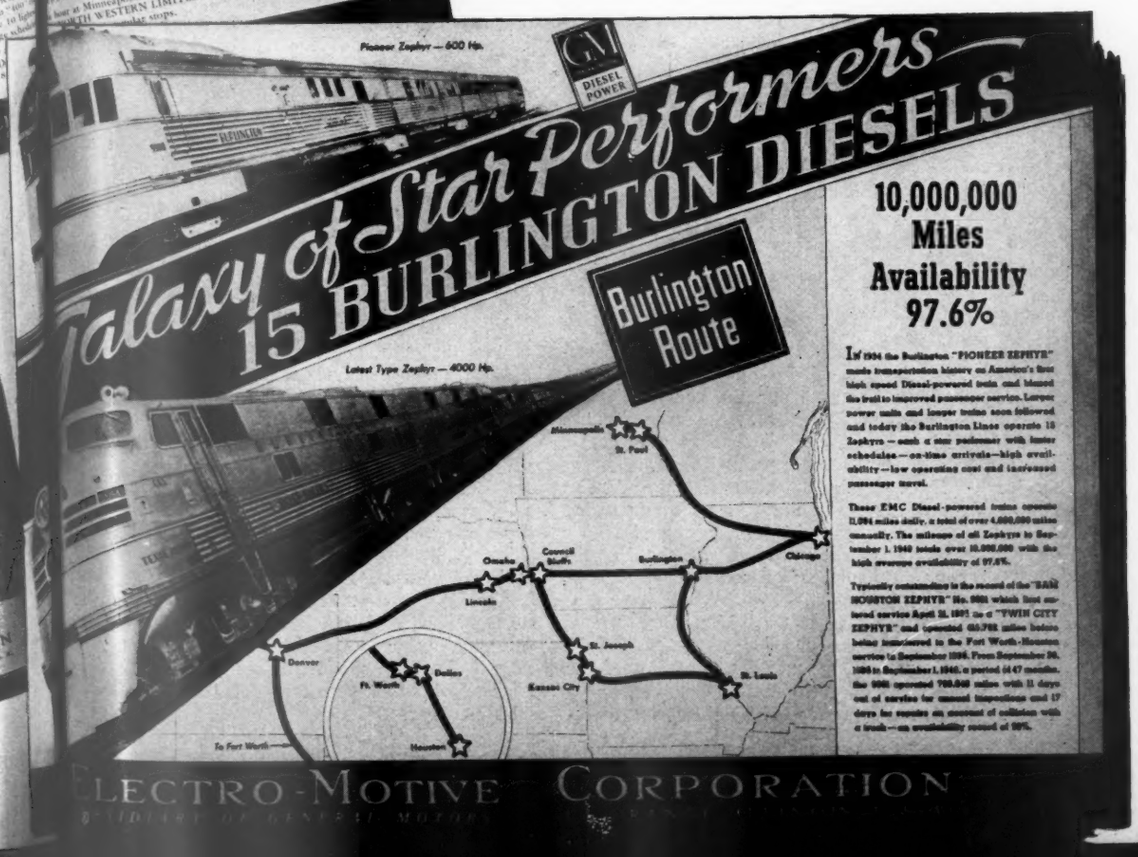
On the Burlington fifteen EMC Diesel-powered trains operated over 10,000,000 miles with the high **availability of 97.6%.**

On the Rock Island thirteen EMC Diesel-powered Rocket locomotives operated 4,534,938 miles with an **availability record of 98.7%.**

On the Baltimore & Ohio six original EMC 3600 Hp. Diesel locomotives operated 3,441,916 miles with an **availability of 95.5%.** Locomotive No. 56 operated an entire year without missing a trip and made 515,485 miles with **99.3% availability.**

On the Chicago & Northwestern two EMC 4000 Hp. Diesel locomotives operated 758,227 miles without missing a trip in over 18 months—an **availability record of 100%.**

ELECTRO-MOTIVE CORPORATION
SUBSIDIARY OF GENERAL MOTORS LA GRANGE, ILLINOIS, U. S. A.



GM
GENERAL MOTORS
DIESEL POWER

part of the purchase price of new equipment costing a total of $5,350,000 and consisting of five 2-10-4 Texas type freight locomotives; two 0-8-0 switching locomotives; 650 90-ton hopper cars; 300 50-ton box cars (class XM-4); 100 50-ton box cars (class XM-3); 50 50-ton flat cars, and 20 all-steel caboose cars.

Erie.—The Erie has asked authority from the Interstate Commerce Commission to assume liability for $3,000,000 of equipment trust certificates, maturing in the amount of $150,000 on June 1, 1941, and $150,000 on December 1, 1941, and a like amount semi-annually on June 1 and December 1, in each year thereafter to and including December 1, 1950. The proceeds will be used as part payment for equipment costing a total of $3,410,000 and consisting of 500 50-ton hopper cars; 250 70-ton drop end gondola cars; 300 50-ton box cars; 100 50-ton furniture cars; and 50 70-ton flat cars.

Illinois Central.—The Illinois Central has undertaken a locomotive-rebuilding and modernization program at a cost of $4,449,900. Of this amount, $2,003,400 is for the modernization and repair of 84 locomotives of the 2-10-2 type. Twenty-five of these have been completed and the balance have been scheduled for this year and next. A total of $883,500 is to go for the modernization of 31 locomotives of the 2-8-4 type, of which 21 have been completed and 12 are scheduled for 1941. A total of $487,500 is allotted for the modernization of 25 Mikado type locomotives, of which one is completed. A total of $295,500 is to go for the assembly of parts into 15 locomotives of the 2-10-0 type, of which 14 have been completed. A total of $780,000 is for the conversion of 13 locomotives, the work on which has already been completed.

Lehigh & New England.—The L. & N. E. has asked the Interstate Commerce Commission for authority to assume liability for $640,000 of 1⅞ per cent equipment trust certificates, maturing in 10 annual installments of $64,000 on December 15, in each of the years from 1941 to 1950. The proceeds will constitute a part of the purchase price of 300 all-steel hopper cars costing a total of $712,500.

Southern.—The Southern has asked the Interstate Commerce Commission for authority to assume liability for $3,000,000 of 1⅞ per cent equipment trust certificates, maturing in 10 annual installments of $300,000 each on December 1 of each of the years from 1941 to 1950, inclusive. The proceeds will constitute 80 per cent of the purchase price of equipment costing $3,750,000 and consisting of five Diesel-electric locomotives, six passenger-baggage cars, 21 coaches, five dining cars, six lounge-tavern cars, four mail-baggage cars, and two mail-storage cars. The new equipment will be used to inaugurate two new all-coach trains, one from New York City to New Orleans, and one from Washington, D. C., to Memphis.

Wabash.—The Wabash, according to company officers, is contemplating expenditure during the next 5 years of approximately $8,000,000 for new equipment which will include 1,800 freight cars, 3 steam locomotives, 15 Diesel-electric switching locomotives and an undetermined number of passenger cars.

AFL RR Unions Continue to Progress

THE Railway Employees' Department, American Federation of Labor, and its affiliated international organizations "have continued to make progress in their various activities during the past year," according to the report of the Federation's executive council which was submitted to the sixtieth annual convention in New Orleans, La., during the week beginning November 18.

The report deals first with the progress of organization work and then with railroad employment. "From the standpoint of personnel," it says in the latter connection, "the railroad industry is prepared to meet any demands upon it, including those of the national defense program, which incidentally has not yet had any appreciable influence on the railroad industry." It is suggested that additional job opportunities for railroaders will be offered when the program is fully underway; but "it should be made clear that the supply of skilled workmen in the railroad industry is ample to meet the needs of that industry, and consequently there will be no need to break down the apprenticeship program or the working conditions which have been established in the railroad industry after many years of effort, under the pretense that this is necessary for national defense."

After having next discussed general transportation legislation, the report came to its section on the vacations-with-pay demand, in which it is pointed out that because of regional difficulties a national conference committee has not yet been formed. In the railroad industry, the report goes on, "paid vacations are still restricted to the executive and supervisory forces and in some instances to clerical workers, but with respect to the latter group vacations are granted only if it can be done without expense to the company. The railroad industry, therefore, which profits the most from a general vacation policy in industry through increased passenger traffic, has perhaps been the most backward in granting vacations with pay to its own employees."

Meanwhile, during the previous week, B. M. Jewell, president of the Railway Employees' Department, addressed to the general chairmen of the Department's affiliates a communication calling for utilization of railroad plants and personnel to the fullest possible extent in the national defense program. By following such a policy, Mr. Jewell said, the government would save money and at the same time avoid delays involved in building new plants and in training workers. "The railroad industry," he went on, "has large plant and facility capacity and in these times, particularly, should do all its own repair work and all its new building within its own plants, with its own facilities, and with its own employees. If there are any excess railroad plants or facilities or employees they should be made available to and engaged as promptly as possible in other national defense work."

Supply Trade Notes

R. S. CLINGAN, formerly of the Republic Steel Corporation, has been appointed Chicago district manager of the Copperweld Steel Company, Warren, Ohio.

◆

WILLIAM M. LEIGHTON, who has represented The Oxweld Railroad Service Company in the Southeastern territory for the past several years, will retire on December 31, 1940.

◆

HENRY H. TIMKEN, JR., vice-president and general manager of the steel and tube division of the Timken Roller Bearing Company, Canton, Ohio, has also been elected chairman of the board to succeed his father, Henry H. Timken, Sr., deceased.

THE AMERICAN CAR & FOUNDRY COMPANY has awarded a contract to the L. O. Stocker Company for the construction of a one-story 50 ft. by 50 ft. brick addition to its car-building plant at St. Louis, Mo.

◆

EARL G. MORGAN, formerly a district representative of the Vilter Manufacturing Company, has joined the air conditioning and refrigeration division of the Worthington Pump & Machinery Corporation as sales representative with headquarters at company's Kansas City, Mo., office.

◆

GEORGE A. BLACKMORE, president of the Westinghouse Air Brake Company since 1936, has been elected by the board of directors to fill the additional office of chairman of the board, succeeding Charles A. Rowan, deceased.

◆

WILLIAM HARTY, chairman of the board of the Canadian Locomotive Company, Ltd., of Kingston, Ont., has been elected a director of the Canadian Car and Foundry Company, Ltd., of Montreal, Quebec.

◆

THE INLAND STEEL COMPANY, Chicago, has opened a district sales office at 40 Wall street, New York, to handle export and domestic business in the eastern territory. Powell Pardee, special representative at New York, has been appointed district sales manager.

W. M. BLACK, vice-president of the American Manganese Steel division of the American Brake Shoe & Foundry Co., with headquarters at Chicago Heights, Ill., has been elected president with the same headquarters. W. E. Crocombe, who formerly headed the American Manganese Steel division, continues as president of the American Forge division. Mr. Black has been with American Manganese since 1912, with the exception of the war years when he served as a lieutenant in the ordnance department of the United States army. He was appointed general sales manager in 1934 and was elected vice-president in 1935.

◆

MARVEL EQUIPMENT CORPORATION, Chicago, has moved its sales office from its factory to 224 South Michigan avenue, Chicago.

◆

L. H. GILLICK, assistant to the vice-president of the Vapor Car Heating Company, Inc., Chicago, has been appointed sales manager. Mr. Gillick was born at Minneapolis, Minn., on August 25, 1898. After attending Northwestern University he entered the employ of the Chicago Car Heating Company, predecessor of the Vapor Car Heating Company, Inc., in January, 1916. After completing a period of training in the shops he was appointed inspector in the Chicago district. On September 1, 1920, he became Northwest representative of sales and service, with headquarters at St. Paul, Minn. In November, 1925, he was promoted to the position of assistant to the vice-president at Chicago.

L. H. Gillick

◆

FRANK H. CUNNINGHAM, who has been associated with the Graham-White Sander Corporation as sales manager, has been appointed vice-president in charge of sales. Mr. Cunningham was formerly with the Norfolk & Western, Standard Stoker Company and Franklin Railway Supply Company.

◆

RANDOLPH B. COOKE, JR., has been appointed southeastern representative of the Gold Car Heating and Lighting Company, with offices in the Royster Building, Norfolk, Va.

Personal Mention

General

W. H. SCHULTZ, assistant master mechanic on the Chicago & North Western at Clinton, Iowa, has been appointed superintendent of motive power of the Lake Superior & Ishpeming, with headquarters at Marquette, Mich.

Master Mechanics Road Foreman

F. B. CLARK, general foreman locomotive department of the Seaboard Air Line at Jacksonville, Fla., has been appointed master mechanic of the North Florida division, with headquarters at Jacksonville.

JOHN F. RYAN, who has been appointed master mechanic of the Louisville & Nashville at Ravenna, Ky., as noted in the November issue, was born on April 18, 1893, at Russellville, Ky. He attended St. Mary's College, St. Marys, Ky., from 1906 until 1909, entering the service of the Louisville and Nashville on January 1, 1910, as an apprentice, first at Russellville, and two years later at the South Louisville shop. He was a machinist and fireman on the O. & N. division from 1914 until 1917, then lead machinist at Ravenna until 1918, when he entered the army, being commissioned a lieutenant at Camp Gordon, Ga. He returned to Ravenna in 1919 as enginehouse foreman, becoming general foreman there in 1927 and master mechanic on September 1, 1940.

John F. Ryan

FRANK W. TAYLOR, general shop foreman on the St. Paul division of the Northern Pacific, has been appointed master mechanic of the Yellowstone division, with headquarters at Glendive, Mont., succeeding F. J. Regan, deceased.

G. W. GILLELAND, master mechanic of the North Florida division of the Seaboard Air Line, has been transferred to the Virginia division, with headquarters at Richmond, Va.

Obituary

ORA CLAIR MONTGOMERY, assistant superintendent of power of the New York Central at New York, died suddenly on November 10 from a heart attack, at the age of 56 years.

Trade Publications

CARBOLOY TOOLS.—Carboloy Company, Inc., Detroit, Mich. Engineering Bulletin GT-123, "Machining Steel with Carboloy Tools," with supplement of data for machining cast iron, non-ferrous metals and non-metallic materials.

◆

MUNITIONS THREADING.—Landis Machine Company, Waynesboro, Pa.—Illustrated bulletin descriptive of various types of die heads and threading machines for munitions threading operations.

LOCOMOTIVE SPOTTER.—Whiting Corporation, Harvey, Ill. Eight-page Bulletin No. LS-C-400. Illustrates and describes construction and operation of high-capacity machine for spotting locomotives while squaring valves, connecting locomotives and tenders, applying rods, etc.

◆

LOCOMOTIVE GAGES.—The Ashton Valve Company, 161-179 First street, Cambridge (Boston), Mass. Thirty-page catalog 44 R.R. Describes and illustrates locomotive gages for motive power, gage fittings, and testing equipment.

◆

V-BELT DRIVES.—The Dayton Rubber Manufacturing Company, Dayton, Ohio. Thirty-six-page illustrated catalog of pertinent data and facts concerning features and applications of Dayton "D-R" V-belt drives and accessories, with complete installation and maintenance instructions. Included also is a pocket-size edition of Parts List and Installation Instructions.

HOLLOW
flexible
STAYBOLTS
W. & L. E.

Leading roads profit by ECONOMY

on the road... in the shop...

FOR EXAMPLE: DE-SCALING DIESEL COOLING SYSTEMS THE SAFE OAKITE WAY

When you are confronted with the important job of de-scaling the cooling system of Diesel-electric locomotives in road or switching service . . . use the successful, SAFE Oakite method approved and standardized by many leading roads.

Let Us Give You More Data On This Maintenance Job

Circulating the recommended solution of Oakite Compound No. 32 quickly removes hard water scale deposits, restores heat transfer and desired cooling efficiency so that you get smooth engine performance. Since it costs nothing to find out . . . let us send you complete data describing this SAFE, economical Oakite method for cleaning and de-scaling Diesel cooling systems. Won't you write us today?

QUALITY MATERIALS
PROMPT DELIVERY
COMPETENT SERVICE

You can depend on all three when you specify Oakite cleaning on any or all your maintenance work:

Cleaning air conditioning equipment

—

Stripping paint from tanks, coaches, locomotives

—

Cleaning air compressors

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Steam cleaning motion gear

—

Washing stainless steel and aluminum cars

OAKITE
RAILWAY SERVICE DIVISION

OAKITE PRODUCTS, INC. 46 Thames St. NEW YORK, N. Y.

REPRESENTATIVES IN ALL PRINCIPAL CITIES OF THE U. S. AND CANADA

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39 New Streamliners

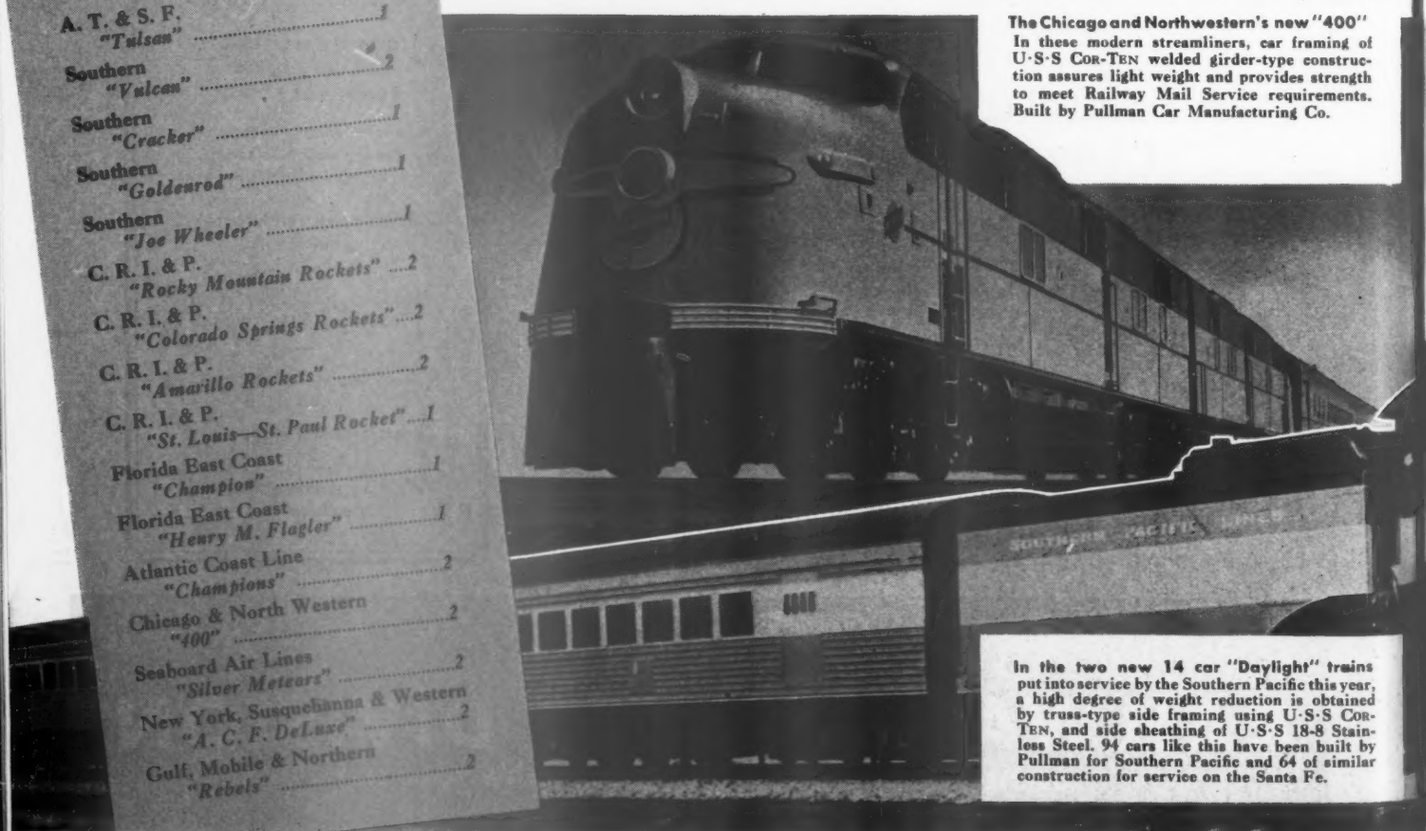
The Rock Island "Rockets" and the new "Silver Meteors" of the Seaboard Air Line shown below, built with U·S·S 18-8 Stainless Steel, are representative of the high type of workmanship, beauty of line, travel comforts and smooth riding qualities that characterize the new high-speed trains. Built by the Edward G. Budd Manufacturing Company.

HERE'S THE LIST:

Traffic-building equipment placed in service since October 1939 built with U·S·S High Tensile Steels

Southern Pacific *"Daylights"*	2
Colorado & Southern *"Zephyrs"*	2
C. B. & Q. *"Silver Streak"*	1
A. T. & S. F. *"Tulsan"*	1
Southern *"Vulcan"*	2
Southern *"Cracker"*	1
Southern *"Goldenrod"*	1
Southern *"Joe Wheeler"*	1
C. R. I. & P. *"Rocky Mountain Rockets"*	2
C. R. I. & P. *"Colorado Springs Rockets"*	2
C. R. I. & P. *"Amarillo Rockets"*	2
C. R. I. & P. *"St. Louis—St. Paul Rocket"*	1
Florida East Coast *"Champion"*	1
Florida East Coast *"Henry M. Flagler"*	1
Atlantic Coast Line *"Champions"*	2
Chicago & North Western *"400"*	2
Seaboard Air Lines *"Silver Meteors"*	2
New York, Susquehanna & Western *"A. C. F. DeLuxe"*	2
Gulf, Mobile & Northern *"Rebels"*	2

The Chicago and Northwestern's new "400" In these modern streamliners, car framing of U·S·S Cor-Ten welded girder-type construction assures light weight and provides strength to meet Railway Mail Service requirements. Built by Pullman Car Manufacturing Co.



In the two new 14 car "Daylight" trains put into service by the Southern Pacific this year, a high degree of weight reduction is obtained by truss-type side framing using U·S·S Cor-Ten, and side sheathing of U·S·S 18-8 Stainless Steel. 94 cars like this have been built by Pullman for Southern Pacific and 64 of similar construction for service on the Santa Fe.

U·S·S HIGH TENSILE STEELS

since last October...

31 built with service-tested U·S·S High Tensile Steels!

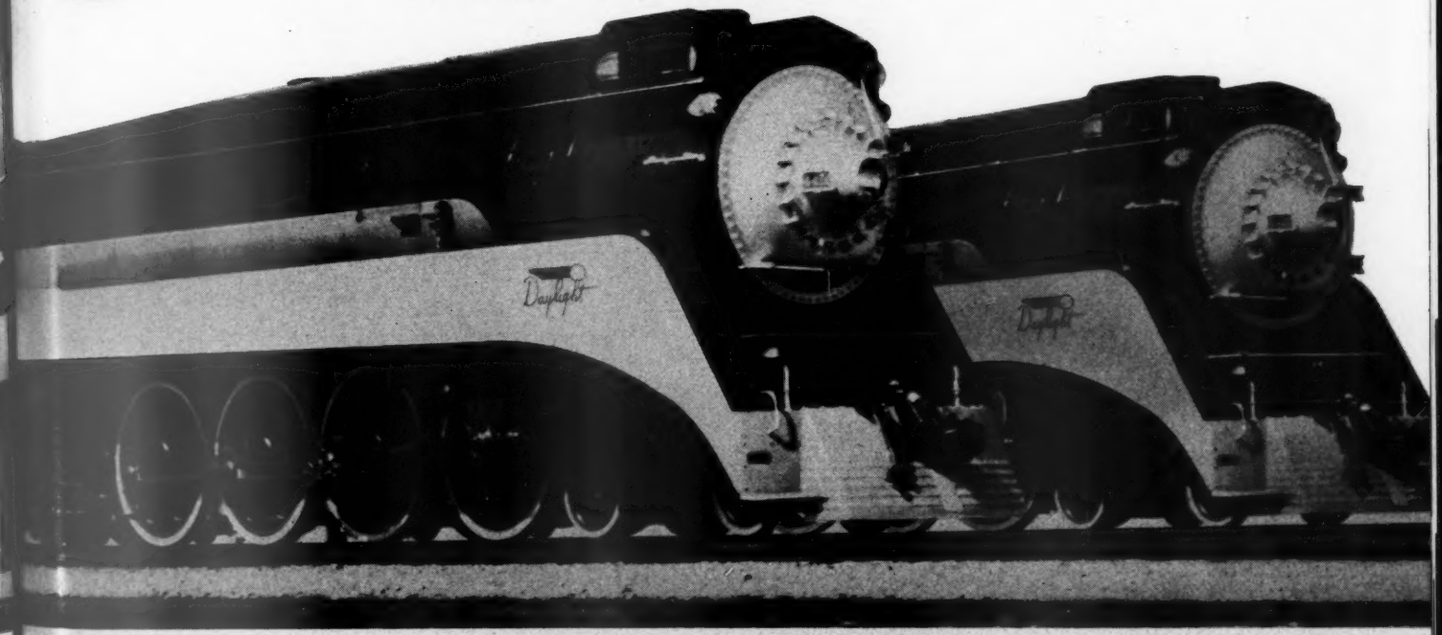
THE large number of modern streamlined trains placed in service in the past 12 months establishes a record in railway history.

We believe it especially noteworthy that again in 1940, as in 1939, almost 80% of this new equipment was built with U·S·S High Tensile Steels —U·S·S Cor-Ten and U·S·S 18-8 Stainless.

This is more than a happy accident. These steels have honestly earned their place as preferred materials for lightweight passenger car construction. Extensive experience in application and in service has proved them eminently fitted for such use. From the standpoint of design, their high strength-weight ratio makes them inherently adapted for lightweight construction. Their greater fatigue strength, which assures greater resistance to vibration, and the high modulus of elasticity of steel, which permits light construction without excessive deflection, are prime factors in determining their choice for such an overwhelming proportion of the modern passenger equipment produced to date.

Important, too, is the fact that both U·S·S Cor-Ten and U·S·S 18-8 Stainless are readily formed and fabricated by all the commonly used shop processes—that both are suitable for spot welding, which makes for efficient and economical joining of light members.

AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York*
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
NATIONAL TUBE COMPANY, *Pittsburgh*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*
United States Steel Export Company, New York
Scully Steel Products Company, Chicago, *Warehouse Distributors*



UNITED STATES STEEL

1300 revenue-boosting

In six 2-car streamlined units of the Southern Railway shown above, U·S·S COR-TEN is used throughout in building the under-frames and also in the super structure where strength and lightness at low cost were essential. Car weight per passenger has been reduced to 1454 lb. These six 2-car units have released a total of 6 steam locomotives, 6 mail compartment cars and 10 coaches for other service. Built by St. Louis Car Co.

U·S·S Cor-Ten is used extensively in the structural members of the two 80-passenger motor rail cars of the New York, Susquehanna and Western, placed in service July, 1940. They make the 15.3-mile trip between Paterson City and Susquehanna Transfer in 20 minutes. This new service in conjunction with bus connection saves commuters about one hour per day between Paterson City, N. J., and Times Square, New York. Built by American Car and Foundry Co.

Five of these DeLuxe Pennsylvania dining cars built principally of U·S·S COR-TEN, weigh 113,240 lb. each, light, as compared with about 170,000 lbs. for former conventional design. In a compression test these COR-TEN cars exceed specified requirements. Built by A.C.F.

Modern streamlined coach (below) built by Pressed Steel Car Co. is 84 ft. 8 in. long over face-plates and weighs only 111,200 lb. in running order but exceeds all A. A. R. strength requirements. Body structure substantially all of U·S·S COR-TEN. Notice the unique window arrangement, said to be especially advantageous for high-speed service.

U·S·S HIGH TENSILE STEELS

passenger cars tell the story

...prove the superiority of U·S·S High Tensile Steels for reducing weight without sacrifice of strength or stamina

IMPROVED lightweight design, better fabricating methods and judicious application of these superior steels—U·S·S Cor-Ten and U·S·S 18-8 Stainless—have made it possible for designers and car builders to reduce passenger car weights generally 30% to 40%. And these weight savings have been accomplished without the loss of a single advantage previously enjoyed.

With this lighter equipment the railways have been able to provide superior service to the public at lower cost to themselves. By reducing the 650 tons represented by the conventional 8-car train to 400 tons, they have obtained equivalent train performance with 1/3 less locomotive capacity. The result has been important and substantial savings. First, from the lowering of initial cost of motive power and second, from the decrease in fixed charges and fuel costs throughout the life of the equipment.

The economic advantages of passenger equipment built of U·S·S High Tensile Steels are exemplified by many of the premier trains that are making new records in traffic and net earnings. Take, for example, the case of the "Daylight" trains of the Southern Pacific. In these 14-car streamliners, a weight reduction of 29.7% is obtained by truss-type side framing using U·S·S Cor-Ten and side sheathing of U·S·S 18-8 Stainless. Earnings have been outstanding—have run as high as $6.28 per train mile and the popularity of the service has made necessary the addition of the two new ultra modern trains added to the "Daylight" fleet this year.

This is not an isolated case, but a typical example as proved by repeat orders to extend the service of the "Zephyrs," "Rebels," "Hiawatha," "Rockets" and other famous trains—all built with U·S·S High Tensile Steels. It is on this record of proved accomplishment that we offer these superior steels for your consideration.

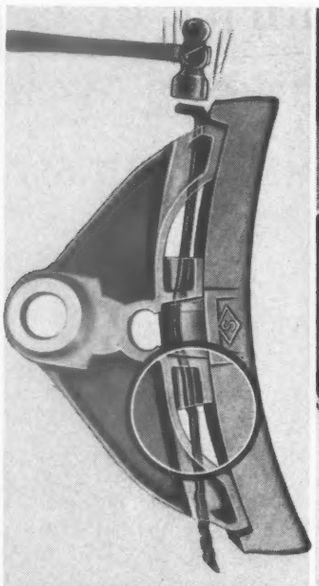
AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York*
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
NATIONAL TUBE COMPANY, *Pittsburgh*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*
United States Steel Export Company, New York
Scully Steel Products Company, Chicago, *Warehouse Distributors*

Atlantic Coast Line "Champion," typical of the 33 completely Budd-built trains now in service. In building this equipment, cold rolled coils of U·S·S 18-8 Stainless Steel are passed through rolling dies to emerge as angles, channels, Z-sections, etc. which are then formed by the Shotweld process into a light structure of tremendous strength.

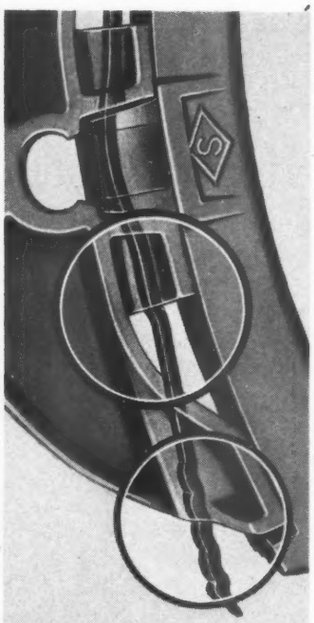
UNITED STATES STEEL

Approved as Alternate

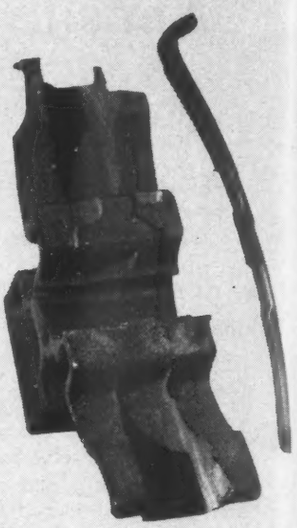
Made of alloy spring steel especially heat treated, the Brake Shoe Lockey serves a triple purpose.



When driven to correct position, the offset in the key drops over the lower pad of the brake head ...



Where it locks in position, holding brake shoe and head so tightly together that ...

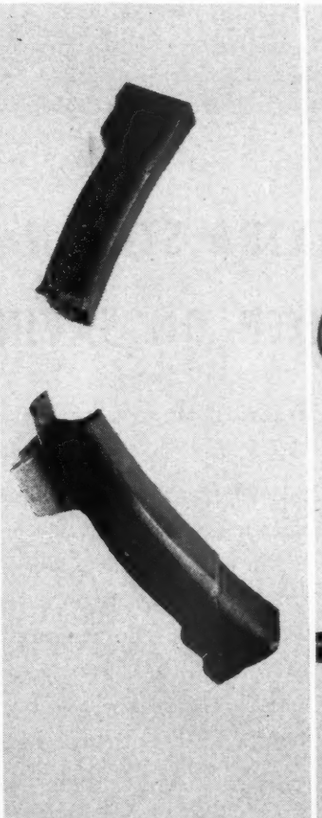


(1) it eliminates wear of brake head and key and

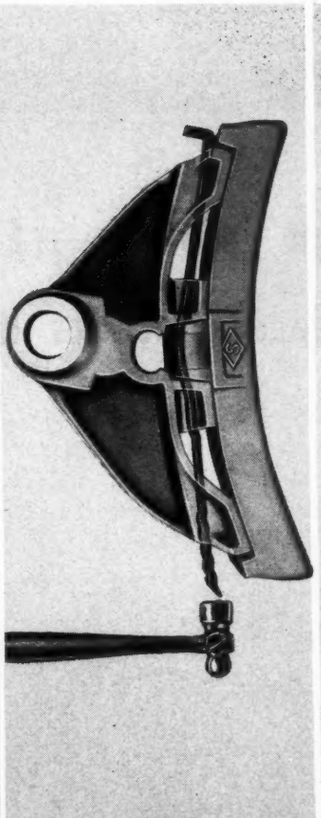
The A.A.R. in adopting the Brake Shoe Lockey as Alternate Standard has signified its approval of the device which our engineers have developed to solve the problem of providing a simple, rugged and durable means of attaching brake shoe to brake head so firmly that loss of shoes or keys is prac-

Standard by the A.A.R.

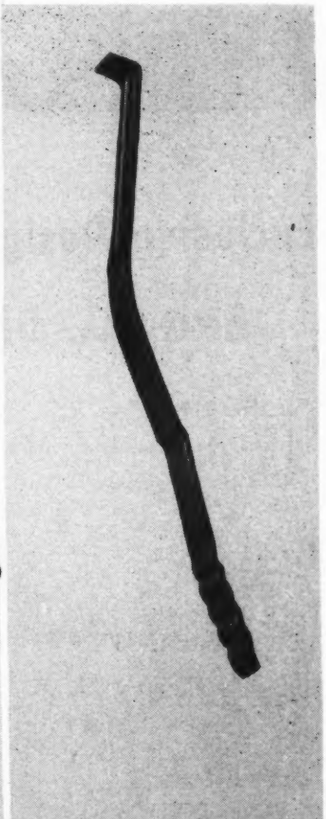
(2) eliminates lost keys and brake shoes caused by chattering brakes or on car dumpers,



(3) and when used with Duplane reinforced shoes, the Lockey prevents, "broken and part missing" failure.



When removal is necessary a sharp blow with a hand hammer on the bottom of the Lockey will release it.



"As good as new." It will not take a permanent set; it is not worn and therefore is ready to be used again.

tically eliminated and wear of heads reduced to a minimum.

Of additional importance to users is the fact that the Lockey can be used repeatedly without sacrificing any of its efficiency as a locking medium.

THE AMERICAN BRAKE SHOE AND FOUNDRY COMPANY
BRAKE SHOE AND CASTINGS DIVISION

Long after they've

Exclusive Design Features—EXTRA STAMINA—Will Make Alco-G.E. Diesel-electrics KEEP ON SAVING MONEY

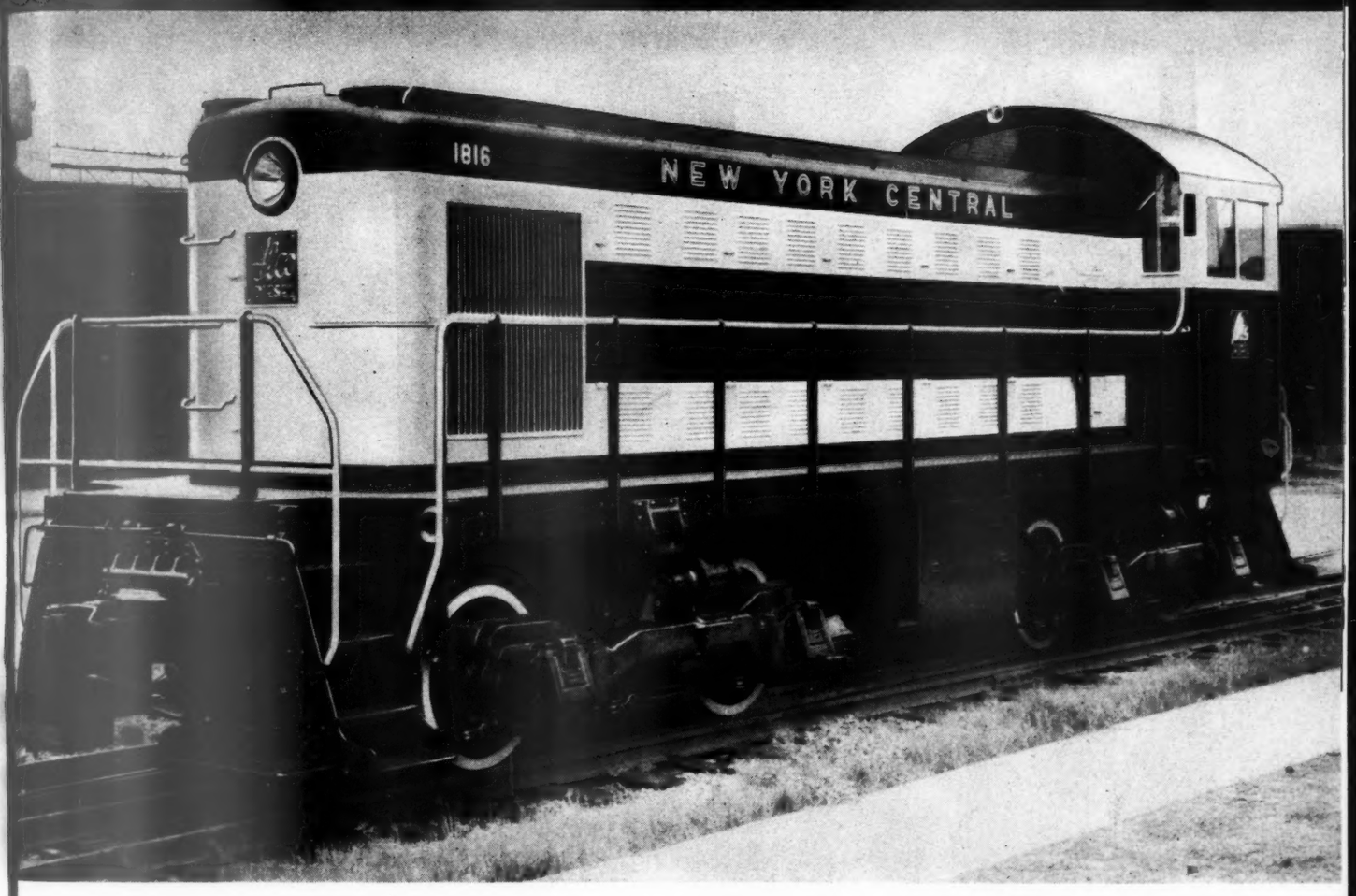
FLASH-IN-THE-PAN economy records don't mean much. Inherently lower operating costs and higher availability will always enable diesel-electrics to show a saving over steam switchers. The big question is, "How long will the saving last?"

Besides all the regular money-saving features of diesel-electrics, Alco-G.E. switchers have a number of extra advantages for fast, smooth switching—such as improved visibility, patented split-pole exciter, and 3-way operation of the traction motors. But, even more important, their sturdy, dependable construction assures low-cost operation year after year—long after they've paid for themselves.

Alco DIESEL

GE

paid for themselves



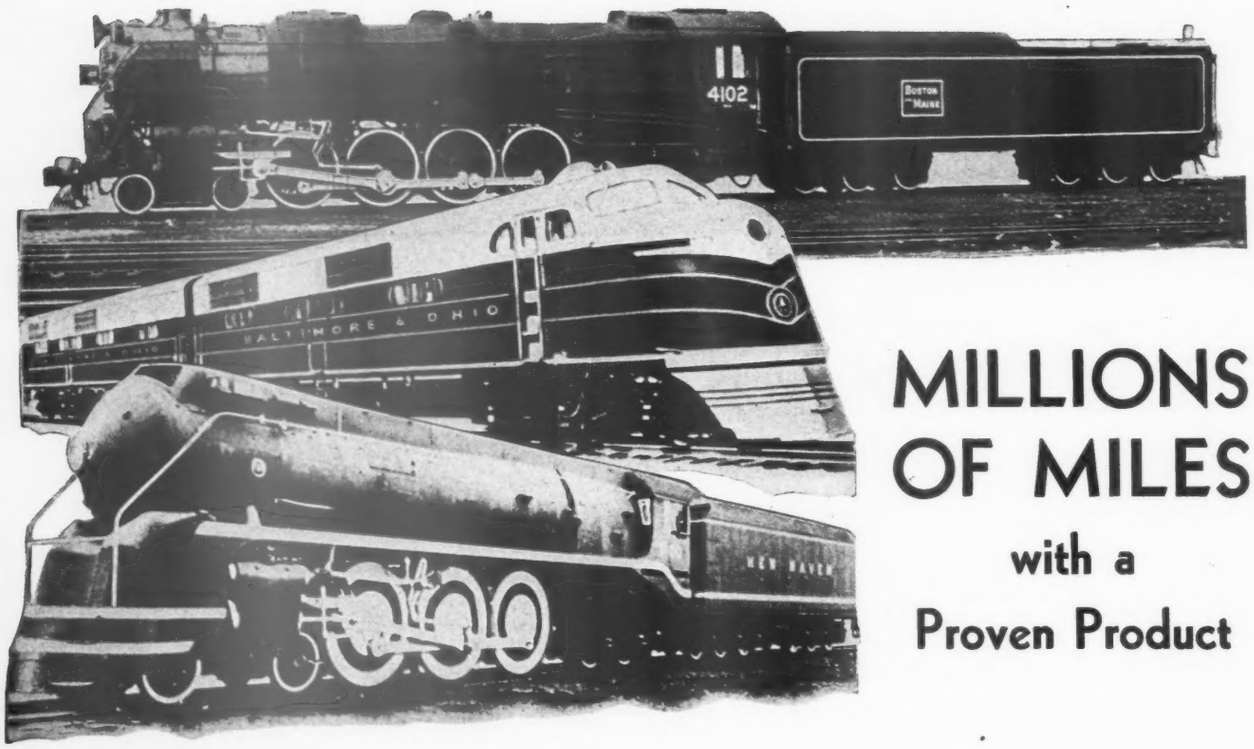
Consider the engine, for example. Every part of Alco's 4-cycle diesel is strong, thoroughly reliable, and easy to understand and maintain. Liners are perfectly symmetrical cylinders with no ports. Piston-pin trouble is unknown because, in 4-cycle engines, reversal of load allows lubrication on both sides of the pin. Pressures and temperatures are inherently low. These factors, combined with Alco's policy of conservative rating, mean low fuel cost, low lubricating-oil consumption, amazingly little maintenance, and *long life*.

G-E electric drive has many important improvements to prolong engine life by producing more rapid acceleration and higher average and top speeds for given engine speeds. New traction motors with exceptionally rigid armatures reduce wear on gears and pinions and lengthen their life.

Alco-G.E. switchers are built for heavy-duty railroad work by the two pioneer builders of railroad motive power. They represent more than 100 years of experience designing locomotives and 50 years building electric drive. No wonder they have an extra measure of stamina to make them an exceptionally profitable investment.

AMERICAN LOCOMOTIVE COMPANY, NEW YORK, N. Y.
GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

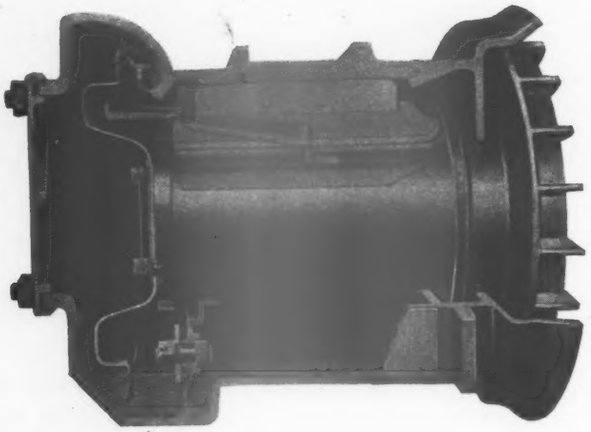
AMERICAN LOCOMOTIVE AND GENERAL ELECTRIC



MILLIONS OF MILES

with a

Proven Product



NATIONAL ISOTHERMOS JOURNAL BOXES

Lowest Friction of any Journal Box made,
because a positive oil film carries the load.
Long Axle Life - - - Long Journal Bearing Life.
No Waste Grabs.
Low initial Box and Axle cost.

NATIONAL MALLEABLE AND STEEL CASTINGS CO
General Offices: CLEVELAND, OHIO
Sales Offices: New York, Philadelphia, Chicago, St. Louis, San Francisco
Works: Cleveland, Chicago, Indianapolis, Sharon, Pa., Melrose Park, Ill

Steel- FIRST LINE OF NATIONAL DEFENSE

Republic Operates the World's Largest Stainless Steel Finishing Mill—

Ten years ago, Republic operated the world's largest stainless steel finishing plant. Each year it seemed to become smaller as ENDURO Stainless Steel found its way into new products—automobiles, trains, airplanes; chemical, textile and food processing equipment; home appliances and even fine jewelry.

Actually, the plant has been enlarged—now covers five acres of floor space—and much new finishing equipment has been added so that, today, Republic still operates the largest stainless steel finishing plant in the world.

Now, to the huge peace-time need for ENDURO for a wide variety of every-day uses is added the demand of industry working feverishly in the defense of America—for bomb chutes in planes, galleys in naval craft, floats for flying boats and a host of other uses where high strength and heat- and corrosion-resistance are imperative.

Republic has looked ahead—has expanded all its facilities—and, fortunately for every man and woman interested in preserving our freedom, is able and anxious to help in the crisis that now squarely faces America—with more and better ***steel—first line of national defense.***

The line of steels and steel products manufactured by Republic is so diversified that we have prepared a complete listing in Booklet No. 199. A copy will be sent you upon request.

REPUBLIC STEEL CORPORATION • CLEVELAND, OHIO

BERGER MANUFACTURING DIVISION • CULVERT DIVISION • NILES STEEL PRODUCTS DIVISION
STEEL AND TUBES DIVISION • UNION DRAWN STEEL DIVISION • TRUSCON STEEL COMPANY

Mechanical Engineers Are Getting Interested

In This Better Roofing Metal

No longer need car roofs be the "Achilles heel" in your maintenance budget. You'll discover this when you try ARMCO ZINCGRIP—a greatly improved galvanized metal that gives better protection against corrosion.

Unlike ordinary galvanized sheets, ARMCO ZINCGRIP can be formed to tight, intricate designs without damaging the zinc coating. This special coating sticks to the metal base through the most severe forming. No flaking or peeling. No cracked off seams or bare spots to invite rusting.

Should this extra assurance of water-tight, trouble-free service appeal to you, this is the way to get it: Just specify ARMCO ZINCGRIP sheets on your next car order. One trial will convince you of its money-saving advantages. Car builders also like ZINCGRIP for its freedom from rejects and its good working qualities. The local ARMCO man will gladly give you more information, or you can write us direct. Armco Railroad Sales Co. Inc., 2901 Curtis St., Middletown, Ohio.

ARMCO ZINCGRIP SHEETS

GIVE FULL PROTECTION

BALDWIN *Diesel-Electrics*

De La Vergne 660-hp. 4-Cycle Diesel engine. Westinghouse generator.

Simplified ENGINE MAINTENANCE

The De La Vergne 1000-hp. and 660-hp. engines, built by Baldwin for their Diesel-electric switching locomotives, are designed to give direct and safe access for inspection and maintenance.

FIVE IMPORTANT POINTS:

1. *Overspeed governor* readily accessible for checking.
2. Periodic testing of *hydraulic governor* and associated operating parts made easy.
3. *Injection nozzles* can be quickly removed for inspection.
4. Continuous supervision of combustion conditions by means of the *pyrometer.*
5. Shoulder high position of *injection pumps* makes for quick inspections.

BLW THE BALDWIN GROUP

THE BALDWIN LOCOMOTIVE WORKS

Philadelphia

NICKEL ALLOY STEELS

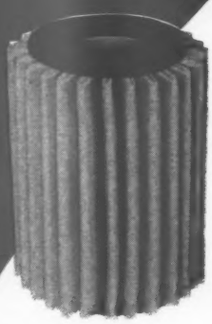
New Nickel-bearing stainless steel "Silver Meteors" proved veritable gold mines for the Seaboard Railway this season. These sleek luxury-coach streamliners attracted waiting lists of passengers for the New York—Miami—St. Petersburg runs. Frills aplenty—eye-appeal that wins revenue—and plenty of appeal for practical railroaders in 1940 designs which minimize deadweight, reduce wear, resist corrosion and cut down upkeep. Every mile, every month, Nickel steels save you dollars.

Meteor coaches, products of Edward G. Budd Mfg. Co., are constructed almost entirely of stainless chromium-Nickel steel, including end underframes, body bolsters and center sills. The latter part is designed to take a buffing load of 900,000 lbs. within the limits of working stresses. Nickel-containing stainless steel is also used for car interior trim as well as drinking water tanks.

The Meteor locomotives, products of the Electro-Motive Corp. (subsidiary of General Motors), La Grange, Ill., are each powered by two 1000 HP Diesels in which Nickel alloys are specified for various stressed parts. Connecting rod forks are made of SAE 3140 Nickel-chromium steel. Driving gears, engine bolts and studs and miscellaneous stressed shafts are of SAE 3135 Nickel-chromium steel. A high strength Nickel alloy cast iron is used for blower timer gears and for cylinder heads and liners. In the locomotives themselves roofs are made of a high tensile low alloy Nickel steel and all truck frames are cast in 2¼% Nickel steel.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

Here's where it's **WISE**
to "Strain at a Gnat"



. . . The Compressor AIR INLET

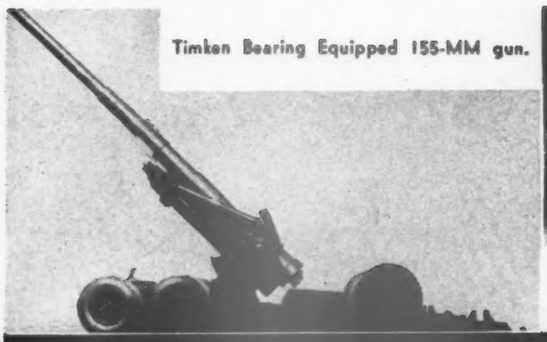
ANY dirt that enters the compressor suction is harmful. It reduces performance integrity and shortens service life. Even fine dust will in time cause excessive wear, stuck rings, and clogged air passages. Therefore to exclude *all* dirt is vital ★ The only way of accomplishing this is to *filter* the intake air, not merely strain it. Our G-1 Suction Filter will do this effectively. It precipitates heavy particles of dirt and intercepts even fine dust suspended in the air. To thus keep compressors clean brings worthwhile operating and maintenance advantages ★ Many railroads have proved that when this filter is used instead of a small inferior strainer their compressors can be kept on the locomotive three to six times as long without overhauling. In the meantime, performance remains consistently reliable ★ Think of the economies YOU too can thus effect — elimination of costly delays due to faulty compressor operation or failure — extension of time between cleaning and renewal — reduction in number of replacements (more pronounced when standard Westinghouse repair parts are used exclusively).

The G-1 SUCTION FILTER comprises a removable element made of high grade close-textured felt of large area, radially pleated over reinforcing wire mesh, and encased in a detachable dirt chamber. It is compact; easy to handle, clean, and replace. Simple, economical maintenance is thus possible.

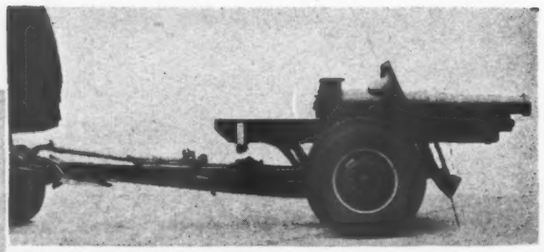
This Suction Filter will save many times its cost in reduced maintenance expense because it helps to eliminate faulty compressor operation and shortening of service life that results from destructive dirt. To "strain at a gnat" now will prevent necessity for "swallowing a camel" later!

WESTINGHOUSE AIR BRAKE COMPANY

WILMERDING PENNSYLVANIA



Timken Bearing Equipped 155-MM gun.

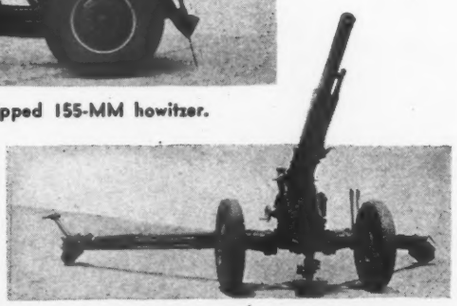


Timken Bearing Equipped 155-MM howitzer.

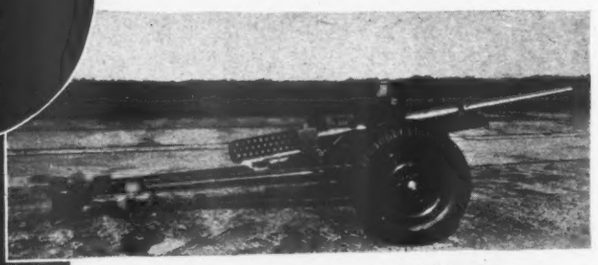
For Defense

Wherever wheels and shafts turn, the extra strength, endurance and accuracy of TIMKEN Bearings are facilitating the mechanization of our military forces . . . both in the equipment itself and in the precision machinery necessary to produce it.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO



Timken Bearing Equipped 75-MM field gun.

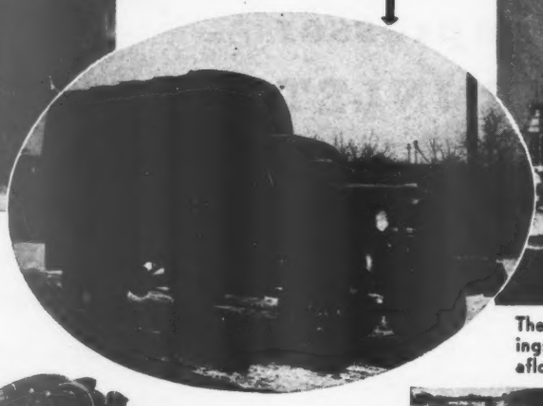


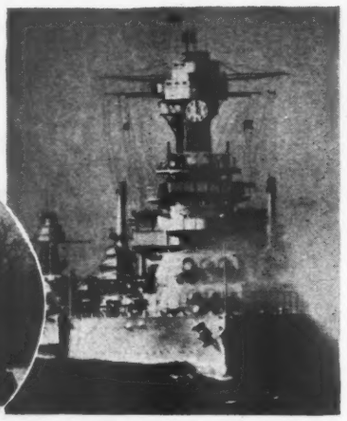
Timken Bearing Equipped 37-MM gun.

Timken Bearing Equipped light tank. →

Timken Bearing Equipped 4-ton truck. ↓

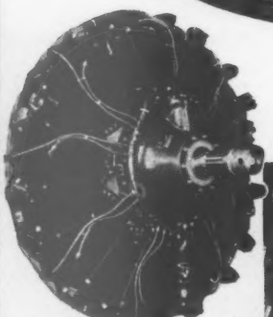
Timken Bearing Equipped 1½-ton truck. ↓



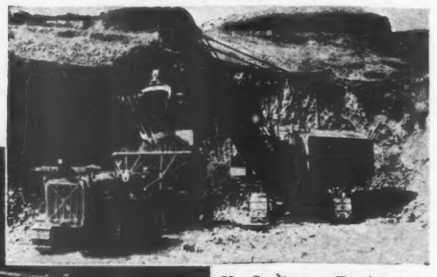


The U. S. Navy uses Timken Bearings in many kinds of equipment afloat and ashore.

U. S. military airplanes take off and land on Timken Bearing Equipped wheels.



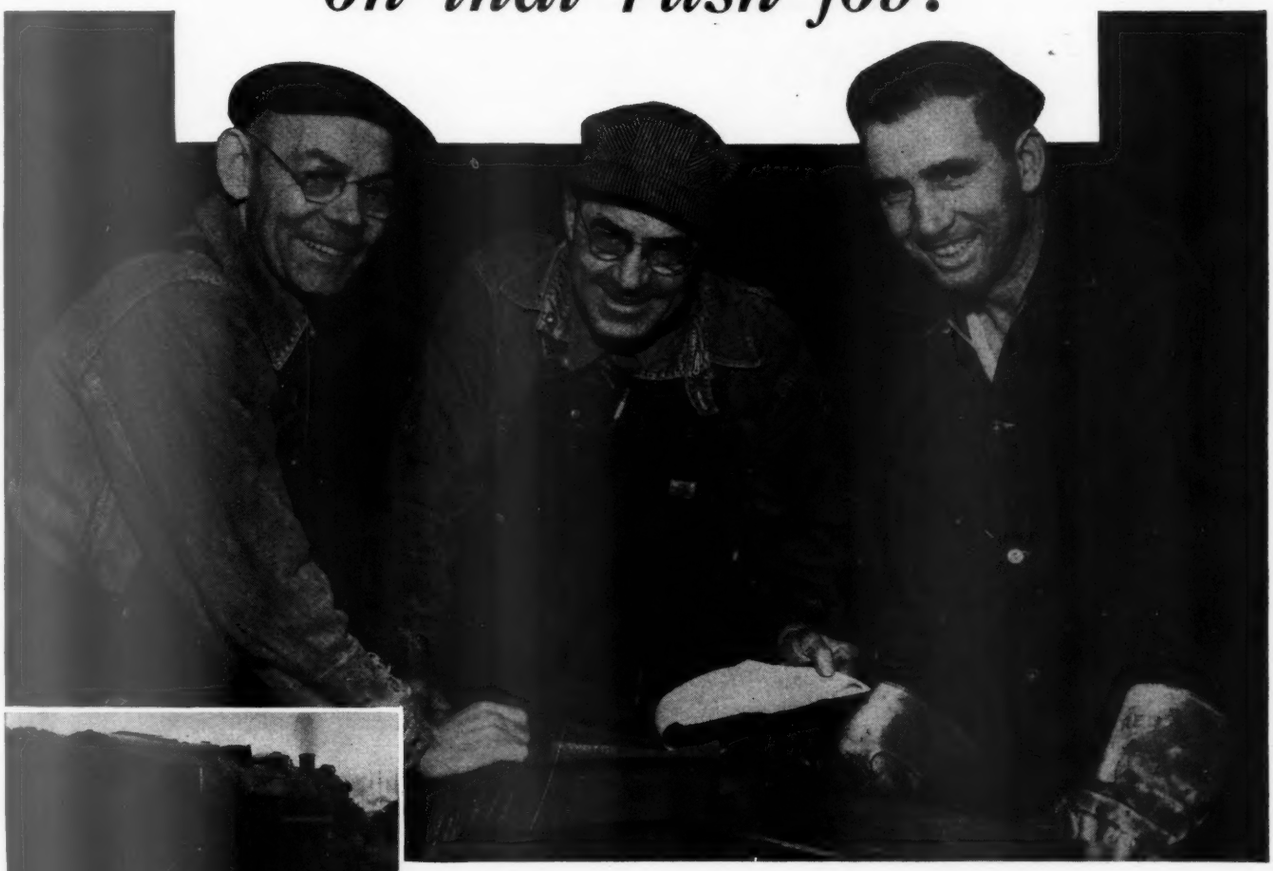
Power for U. S. war birds—Timken Bearing Equipped engines.



U. S. Army Engineers use a wide variety of Timken Bearing Equipped machines.

Millions of dollars worth of Timken Bearing Equipped precision machine tools will speed up our vast defense program.

We sure saved time on that rush job!



"THE foreman frowned when No. 89 limped into the shop yesterday morning with a rush tag on her. They wanted her back for the Thursday schedule. We heard him say there wasn't a ghost of a chance.

"But there she goes—finished several hours ahead of schedule."

Unless you work with boiler tubes, it's hard to believe that they could make so much difference. A tube that flares, rolls, and beads easily saves minutes all along the line. It never splits or cracks. It eliminates waste in time and materials. And when you add up all those minutes saved, you'll find that a change to NATIONAL Seamless Boiler Tubes will often save several hours on a single repair job.

Controlled annealing gives these tubes exactly the right properties—makes them just soft enough for easy installation, just hard enough for maximum strength. Each tube is pierced from a solid billet of highest quality killed open-hearth steel, then rolled inside and out to produce walls of uniform strength throughout. These tubes have no weld, no line of longitudinal weakness. They are "Walls Without Welds," strong, uniform, and easy to install. Specify them both for new equipment and old, as extra assurance of long, satisfactory service. Our Field Service men will be glad to help with your problems.

NATIONAL TUBE COMPANY

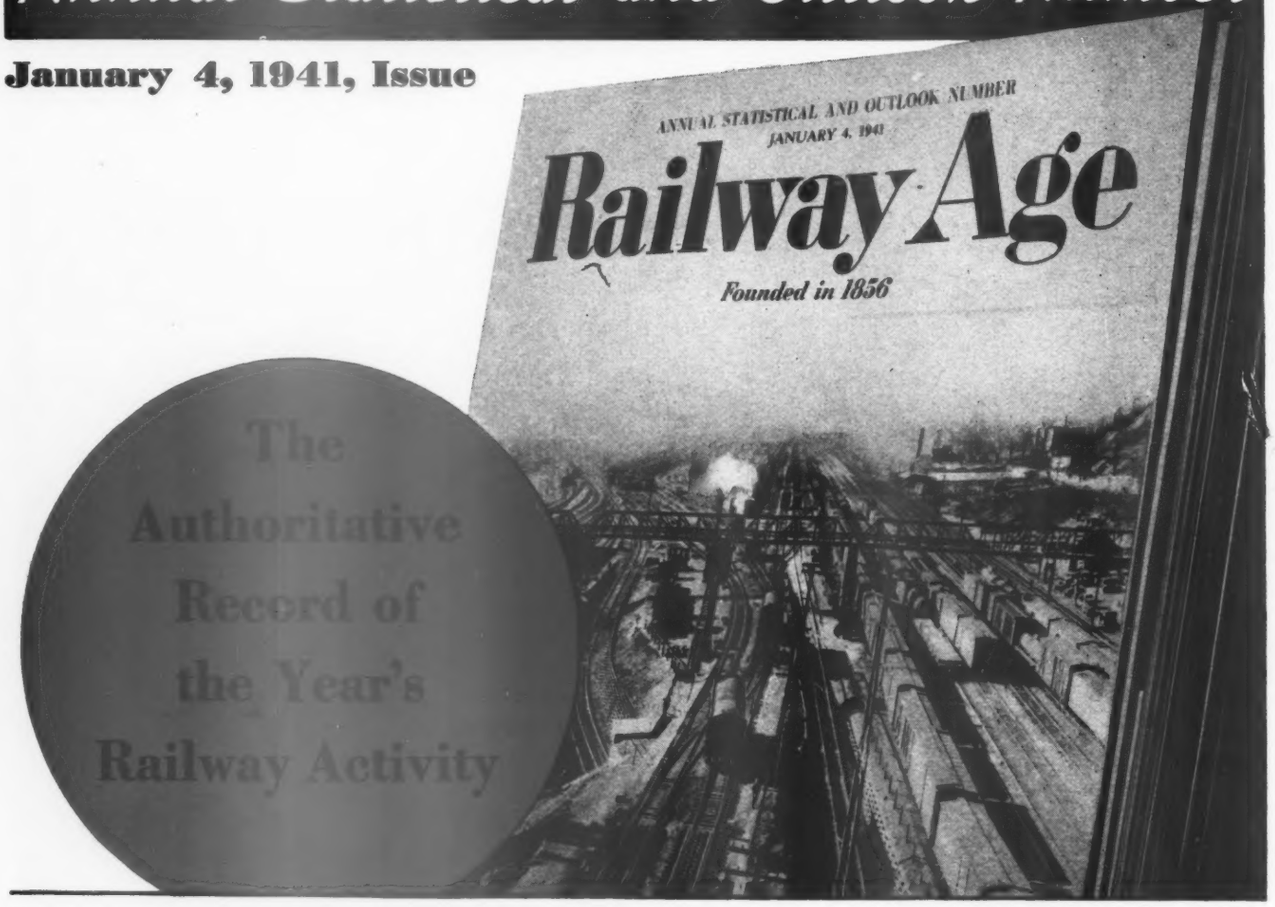
PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

UNITED STATES STEEL

Annual Statistical and Outlook Number

January 4, 1941, Issue


ANNUAL STATISTICAL AND OUTLOOK NUMBER
JANUARY 4, 1941
Railway Age
Founded in 1856
The Authoritative Record of the Year's Railway Activity

EACH year, the Annual Statistical and Outlook Number of the *Railway Age* provides a comprehensive and authoritative record of the past twelve months' railway activities and the outlook for the year ahead . . . statistical and analytical information, much of which is available from no other source.

The 1941 Annual Number will be the January 4, 1941, issue of the *Railway Age*. It will be unusually timely because of the vital importance of railway transportation facilities in the national defense program.

An institution of more than thirty years' standing, this important reference volume furnishes a vital statistical record which is sought and used in all quarters. In fact, each year, hundreds of extra copies are purchased by the railways so that ample copies will be available for continuous reference throughout the year.

Again in 1941, the Annual Number will contain both a comprehensive outlook section and a statistical and review section. The outlook section will feature a series of articles discussing the important trends and developments in the railway industry today. The statistical and review section will analyze railway operations of 1940, and will present detailed statistical information on all phases of 1940 activities, including the annual compilation of orders for equipment.

To Manufacturers

The Annual Statistical and Outlook Number offers manufacturers an unusually timely opportunity to start their 1941 sales campaign vigorously in all parts of the railway industry. With the uptrend in railway activity, the stage is set for a detailed presentation of your railway products to key railway men in all parts of the railway industry who will read and refer to the Annual Statistical and Outlook Number. Write your nearest *Railway Age* office for more information and for making space reservations.

Simmons-Boardman Publishing Corp.
30 Church Street, New York, N. Y.
105 West Adams Street, Chicago — Terminal Tower, Cleveland
Washington, D. C. — Los Angeles — San Francisco — Seattle

MORE *Miles* PER CAR

HAVE YOUR TRUCKS BARBER STABILIZED

Maximum utilization of freight equipment through greater mileage per car and heavier loading, are recognized by railroads and shippers alike as major factors in the solution of unprecedented transportation problems that lie just ahead.

Easy riding cars that reduce maintenance and minimize the time spent in repair shops, unquestionably contribute to the goal: "MORE MILES PER CAR."

When freight cars are BARBER STABILIZED, easy riding is **assured**—destructive spring bouncing and breakage are eliminated by controlled bolster spring action—cars and lading protected.

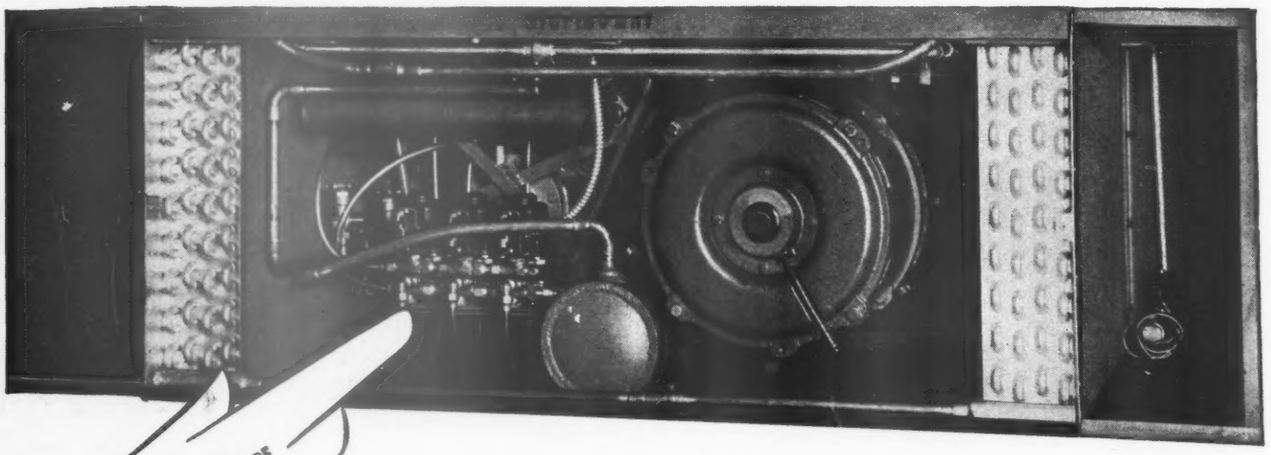
A truck that is BARBER STABILIZED is the **only** truck that is **initially tight** and always STAYS TIGHT. There's no looseness and wear between bolsters and columns. It automatically takes up its own wear.

Specify BARBER STABILIZED PARTS for long, satisfactory car life—trouble free service—reduced maintenance expense.

DESIGNED FOR USE WITH OR WITHOUT SPRING PLANKS — ALSO WITH OR WITHOUT LATERAL MOTION

STANDARD CAR TRUCK COMPANY
332 SOUTH MICHIGAN AVENUE CHICAGO, ILLINOIS

1 LARGE POWER SAVINGS
2 LESS WEAR
3 FAR GREATER COMFORT



VARIABLE OUTPUT FEATURE ELIMINATES FREQUENT FULL-LOAD CYCLING

with this Sturtevant Compressor-Condenser Unit

The three solenoids, shown, cut-out the individual compressor cylinders—automatically—as load decreases, eliminating frequent full-load cycling and greatly reducing stops and starts.

Also—individual compressor cylinders cut-in automatically as compressor starts. Therefore, you get a nearly-zero starting load.

As you know, frequent full load cycling—continuous starting and stopping—is a problem with ordinary compressor-condenser units. Completely eliminated is this disadvantage in the Sturtevant Compressor-Condenser Unit shown.

Because of its *variable output* feature:

1. The Sturtevant Compressor-Condenser Unit runs almost continuously. No frequent starting and stopping.
2. But, *most of the time* it operates only *at less than full load.* Variable output is controlled by a device actuated by the suction pressure of the compressor. It responds to load demands—ranging from full to no load—by cutting in and cutting out individual compressor cylinders. Under *very* light loads, for example, all cylinders are cut out but one.

   The divided evaporator permits automatic closing of a portion of the evaporator coil, when only one or two of the compressor cylinders are pumping Freon.
3. Therefore, temperature and humidity in the car remain practically fixed.

To sum up, the outstanding advantages of the Sturtevant Compressor-Condenser Unit are:

1. Large saving in horse power.
2. Less wear. Saving in maintenance.
3. Far greater comfort for passengers.

Ask our nearest office to supply full information regarding this important Sturtevant development.

Sturtevant RAIL VANE UNITS OR SYSTEMS

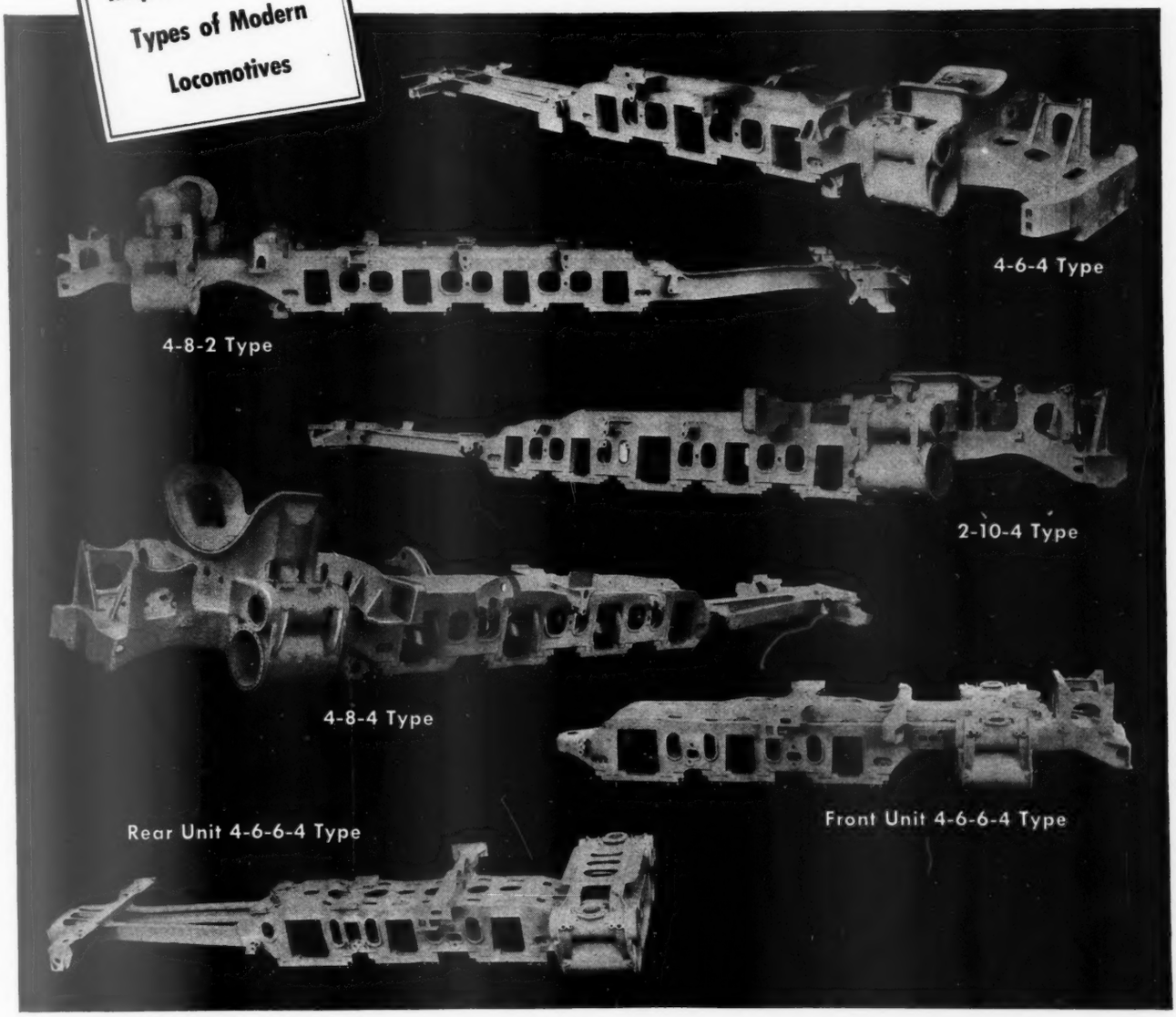
Sturtevant "Railvane" Units or Systems are used by 37 railroads. "Railvane" Air Conditioning is protected by 40 issued patents and other patents pending.

B. F. STURTEVANT COMPANY
Hyde Park, BOSTON, MASS. *Branches in 40 Cities*
B. F. Sturtevant Company of Canada, Ltd.
Galt, Toronto, Montreal

COMMONWEALTH
LOCOMOTIVE BEDS

Meet the Intensive Present Day Service Requirements of All Types of Modern Locomotives

Assure GREATER STRENGTH LOW MAINTENANCE

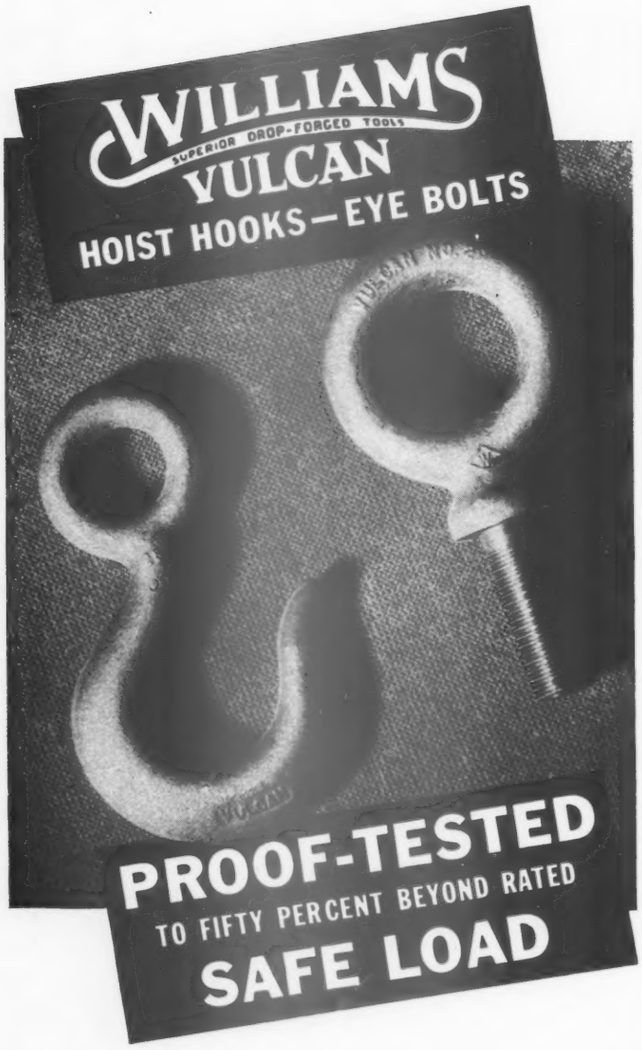


COMMONWEALTH One-Piece Cast Steel Beds have introduced a new era in locomotive construction and operating economy by eliminating, or greatly simplifying, many problems of design and maintenance, and increasing the serviceability of the locomotive. Cylinders and frame structures, being cast integral, cannot loosen . . . this unit construction assures permanent alignment . . . many other component parts of the locomotive last longer.

Railroading of today requires modern locomotives equipped with Commonwealth One-Piece Beds.

GENERAL STEEL CASTINGS

EDDYSTONE, PA. • • • GRANITE CITY, ILL.



ALL Williams' "VULCAN" Hoist Hooks and Eye Bolts are drop-forged from carefully selected steel, and heat-treated after forging. Every individual Hook and Eye Bolt is *proof-tested to 50 % beyond its rated* "safe working load." For safety sake, insist that you get this extra assurance of strength and dependability.

"Vulcan" Hoist Hooks are furnished in Shank and Eye patterns—1/2 to 25 tons capacity. Identify them by the orange tip.

"Vulcan" Eye Bolts are furnished in Plain and Shoulder patterns, shanks blank or threaded, in a complete range of sizes—1/5 to 16 tons capacity.

Sold by industrial distributors everywhere.
Literature on request

J. H. WILLIAMS & CO., 225 Lafayette St., NEW YORK

STATEMENT of the ownership, management, circulation, etc., required by the Acts of Congress of August 24, 1912, and March 3, 1933, of *Railway Mechanical Engineer*, published monthly at Philadelphia, Pa., for October 1, 1940.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Roy V. Wright, who, having been duly sworn according to law, deposes and says that he is the Editor of the *Railway Mechanical Engineer* and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, Simmons-Boardman Publishing Corp., 30 Church St., New York, N. Y.
Editor, Roy V. Wright, 30 Church St., New York, N. Y.
Managing Editor, C. B. Peck, 30 Church St., New York, N. Y.
Business Manager, R. E. Thayer, 30 Church St., New York, N. Y.

2. That the owners are: Simmons-Boardman Publishing Corporation, 30 Church Street, New York, N. Y.; Stockholders of 1 per cent or more of the total amount of stock are: I. R. Kerfoot, 15 Hillcrest Dr., Pelham Manor, N. Y.; P. A. Lee, Hopatcong, N. J.; Henry Lee, Hopatcong, N. J.; E. G. Wright, 398 N. Walnut Street, E. Orange, N. J.; S. O. Dunn, 105 West Adams Street, Chicago, Ill.; C. E. Dunn, 3500 Sheridan Blvd., Chicago, Ill.; L. B. Sherman, 375 Sheridan Road, Winnetka, Ill.; Mae E. Howson, 105 West Adams Street, Chicago, Ill.; B. L. Johnson, 6949 Bennett Avenue, Chicago, Ill.; Spencer Trask & Company, 25 Broad Street, New York, N. Y. General partners of Spencer Trask & Company are: Edwin M. Bulkley, Walnut Street, Englewood, N. J.; Acosta Nichols, Cold Spring Road, Oyster Bay, N. Y.; Cecil Barret, Carlyle Hotel, New York, N. Y.; C. Everett Bacon, 16 Erwin Park, Montclair, N. J.; F. Malbone Blodget, 65 Patterson Ave., Greenwich, Conn.; Arthur H. Gilbert, 440 Park Ave., New York, N. Y.; Henry S. Allen, 407 Highland Ave., Orange, N. J.; William Kurt Beckers, South Salem Road, Poundridge, N. Y.; Edwin M. Bulkley, Jr., 21 Sturgis Road, Bronxville, N. Y.; J. Taylor Foster, Parsonage Lane, Greenwich, Conn.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

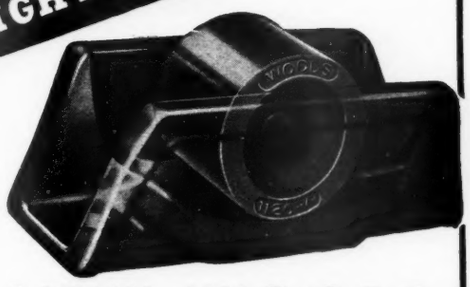
ROY V. WRIGHT.

Sworn to and subscribed before me this 30th day of September, 1940.

EDMUND J. PUYDAK.

[SEAL] (My commission expires March 30, 1941.)

STRONGER — LIGHTER, too!



Patent 1,958,178 A.A.R. Spec.

The NEW WOODS
ANTI-FRICTION
SIDE BEARING

Designed to provide durability in excess of service needs, and maximum protection against wheel flange and rail head wear.

The NEW forged steel roller and housing adds STRENGTH,—reduces weight. Note the web and rim construction and equalized metal sections of roller, permitting adequate, uniform heat treatment *THROUGHOUT.*

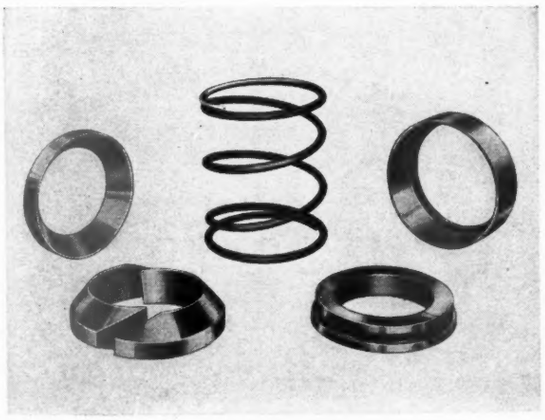
For best results, specify WOODS

Backed by over 40 years success on leading roads

Write for information

EDWIN S. WOODS & COMPANY
4710 W. DIVISION STREET - CHICAGO, ILL.

KING PACKING PARTS
of Standard Design



RINGS
SPRINGS—SLIDING PLATES
RETAINERS—SHELLS

In Stock for Prompt Shipment

The U. S. Metallic Packing Company
PHILADELPHIA, PA.

Representatives in *Canada:* Joseph Robb & Co., Ltd., *Montreal*

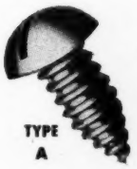
NO "DOUBTFUL SCREWS" on AA planes!

American Airlines, Inc. speeds repairs, keeps maintenance costs low with Parker-Kalon Self-tapping Screws

To maintain rigid flight schedules, American Airlines' Maintenance Department must avail itself of every aid for speedy repairs, yet without sacrificing safety. With these factors to consider, it cannot afford to use "doubtful screws" . . . screws that look okay but of which a percentage fail to perform properly, slowing up work and making unsafe fastenings. That is why American Airlines has standardized on Parker-Kalon Quality-Controlled Self-tapping Screws, which are invariably dependable.

And by writing Parker-Kalon Screws into their specifications, most aircraft manufacturers, including Douglas, Boeing, Lockheed, Glenn L. Martin and Consolidated, are likewise assured of unhampered production schedules.

Remember, when you buy Parker-Kalon you get dependable quality . . . quality controlled by the famous Parker-Kalon Research Laboratory. Get free samples . . . test them . . . see for yourself! Write Parker-Kalon Corporation, 194-198 Varick Street, New York, N.Y.


TYPE A

Quality-Controlled
TYPES, SIZES, HEAD-STYLES FOR EVERY ASSEMBLY OF METAL OR PLASTICS

HEX-HEAD

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

SEND FOR SAMPLES
PARKER-KALON
HARDENED
Self-tapping Screws

Parker-Kalon Corporation,
194-198 Varick St., New York, N.Y.
Please send us Free Samples of Self-tapping Screws.

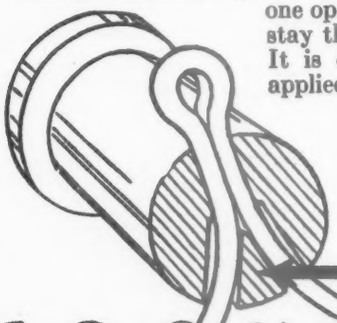
Company _____
Address _____
City & State _____

Greater SAFETY For a Lower Cost

WHY take chances with ordinary cotters—especially since the speeds of all trains have been increased?

Every application on a car, locomotive or any other moving vehicle can be made in absolute safety with the COOKE Pin and Cotter.

A couple of taps with a hammer drives the COOKE Cotter into place. It is securely locked in one operation—and it will stay there until removed. It is easily and quickly applied. You save time, money and promote maximum safety.



Note: This wedge opens, spreads and locks the cotter, thereby eliminating vibration and wear.

COOKE PIN and COTTER

"SELF OPENING—SELF LOCKING"

American Railway Products Co.

162 Post Road, Darien, Conn.

TRADE **Pantasote** MARK

The original successful Artificial Leather.

The National Standard for window and vestibule curtains and seat upholstery. Nearly a half century service tests have established its superiority.

TRADE **Agasote** MARK

Available in sizes up to eight by fourteen feet (8' x 14').

For Passenger Car, Locomotive and Bus headlinings and interior trim. A homogeneous waterproof board of great density and tensile strength. It will not warp, blister nor separate.

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Eliminating extra tender gallonage and partial or all present permanent Water Tanks ! ! !

WHAT WILL SUCH AUXILIARY and "PORTABLE" UNIQUE, SIMPLE and INEXPENSIVE WATER-SERVICE CARS SAVE YOUR COMPANY IN INVESTMENT, OPERATING and MAINTENANCE COSTS and REDUCED TRAIN SCHEDULES ? ? ?

Every day without them is costing your Company real money!
So, WRITE to us TODAY for our proposition.

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13470 S. Brainard Ave., Chicago, Illinois
Cars and Locomotives; all types — Car Parts — Machinery & Equipment — Etc.
"Anything containing IRON or STEEL"

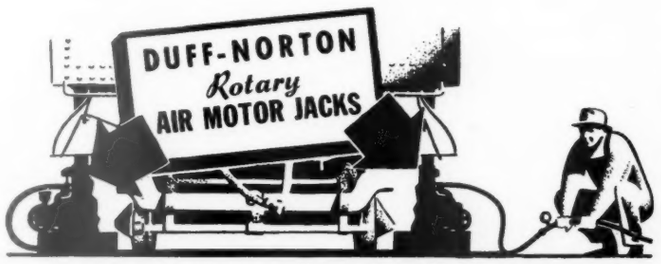
Classified Advertisements — Help and Situation Wanted advertisements appearing in the "Get Together Department," 10c a word an insertion. Minimum charge $2.00 for each insertion. For Sale Advertisements $10.00 a column inch. Any number of inches may be used. Copy must be in this office by the 10th of each month preceding to insure insertion in the issue.

100% RETURN in 66 days!

DUFF-NORTON JACKS

PROVE GOOD INVESTMENT

A CAR-RAISING AND LOWERING TEST—with manually operated jacks, four men required 30½ minutes (122 man-minutes).



WITH DUFF-NORTON ROTARY AIR MOTOR JACKS, SAME CAR, SAME LIFT—one man did the job in 20 minutes! (20 man-minutes).

How's this for an investment . . . 100% return in 66 days! And from then on savings piled up at the rate of $350.00 per month!

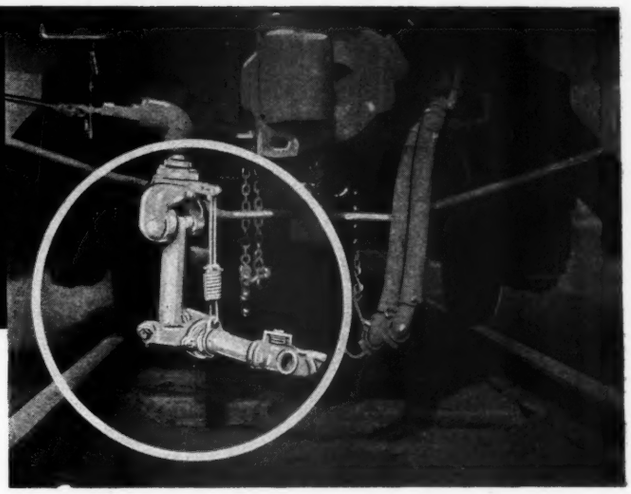
In the passenger-yard of a prominent mid-western railroad, a series of car-jacking tests was run under normal operating conditions to determine the labor cost of jacking-up and moving railroad cars using, first the customary manually operated jacks and then Duff-Norton Rotary Air Motor Jacks. When the results were tabulated, this road found that the Duff-Norton Power Jacks could save enough *in labor cost alone* to pay for themselves in 66 working days! And each month substantial profits continue to accumulate.

Write today for full data concerning the advantages of power jacking, and descriptive information about these sturdy, dependable railroad-type air motor jacks.

THE DUFF-NORTON MANUFACTURING COMPANY · PITTSBURGH, PA.
CANADIAN PLANT, COATICOOK, QUEBEC "THE HOUSE THAT JACKS BUILT"

AUTO-TITE FLEXIBLE BALL JOINTS

(Automatically Tight)



Application Now Will Effect Big Savings

There is still plenty of time to start a program which will effect a big savings in the operating costs of this winter.

Our manufacturing facilities and reserve stocks enable us to insure immediate deliveries of AUTO-TITE FLEXIBLE BALL JOINTS for any class of service.

Applications now on your passenger cars, direct steaming systems and other steam lines, where leak-proof flexible joints are necessary, will solve annoying maintenance problems and reduce fuel consumption.

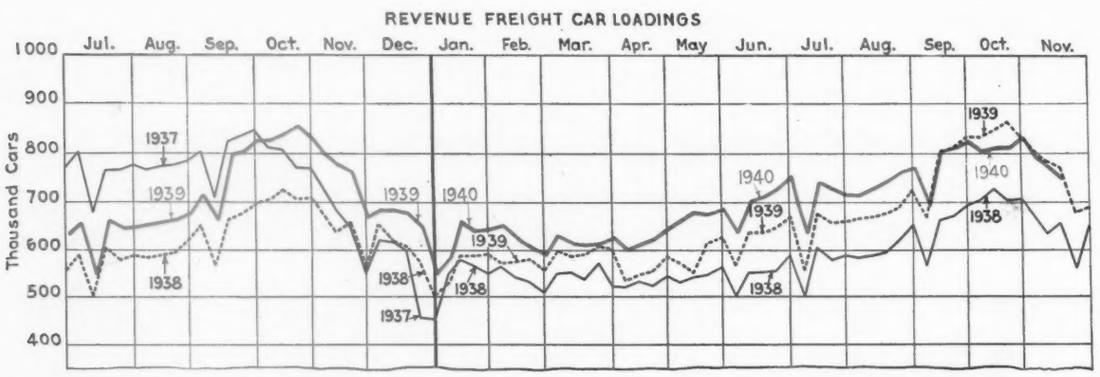
AUTO-TITE FLEXIBLE BALL JOINTS have an exclusive feature which automatically compensates for any wear and assures leak-proof performance. Why not investigate?

SUPERIOR RAILWAY PRODUCTS CORPORATION, PITTSBURGH, PA.

THE EDITOR'S DESK

USE YOUR HEAD

The freight car loadings chart indicates that for several weeks, except for the one ending October 26, business has been somewhat lighter than for the corresponding dates in 1939. It will be recalled that business picked up rapidly when Britain entered the war at the beginning of September last year. This was followed by a falling off in business during the following February and March, but the car loadings began to pick up and to grow steadily from about the middle of April.



The general belief at this time seems to be that because of the needs of Britain and our own national defense program, which is rapidly getting under way, business will hold up well during the coming months and that this will be reflected in the traffic and earnings of the railroads.

Many railway supply companies have taken on government orders for munitions and war supplies. Certain materials are already difficult to get. The railroads should see to it that their case is well presented from a priorities standpoint, where materials or equipment are essential to their continued efficient operation. Certainly, in any case, it will take much longer to secure many materials and supplies than under the conditions which existed during the 30's.

Just as one can no longer march up to a ticket window and be sure of getting Pullman accommodations at the last minute; just as it is again becoming necessary to make advance reservations at hotels in business and industrial centers; so it is also advisable to plan for and order materials and supplies well in advance, in order to assure delivery when they are needed.

There seems to be no need of becoming unduly excited, but certainly the situation requires careful planning and the very best use of available resources.

Roy V. Wright

Rx for Superior Packing Performance against Steam

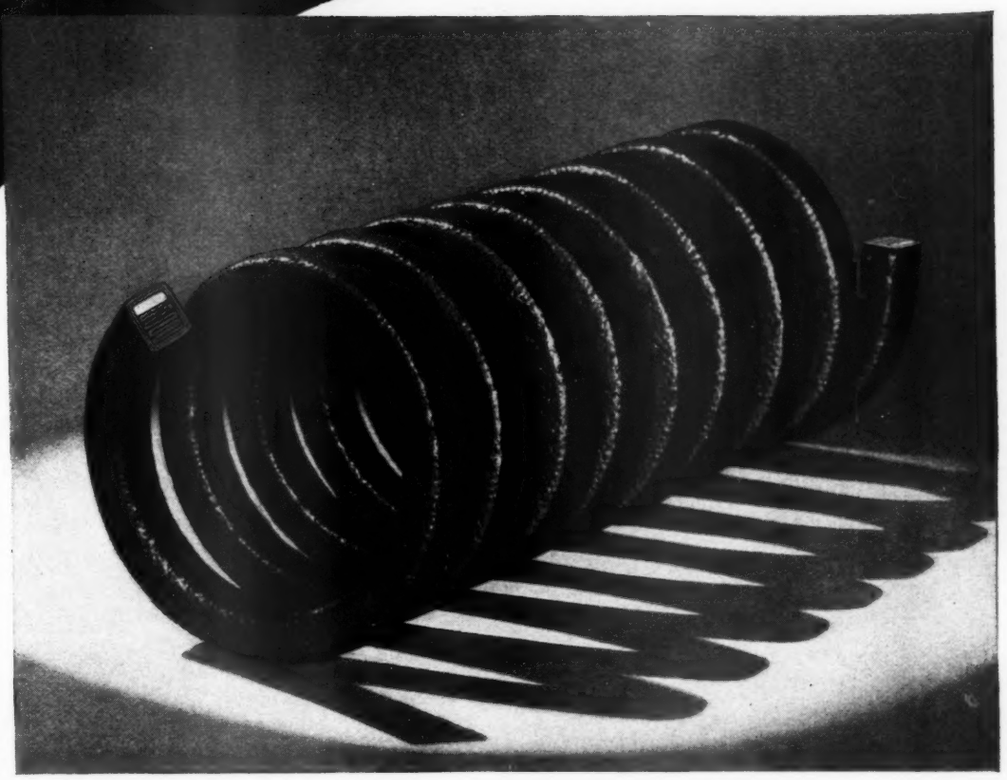
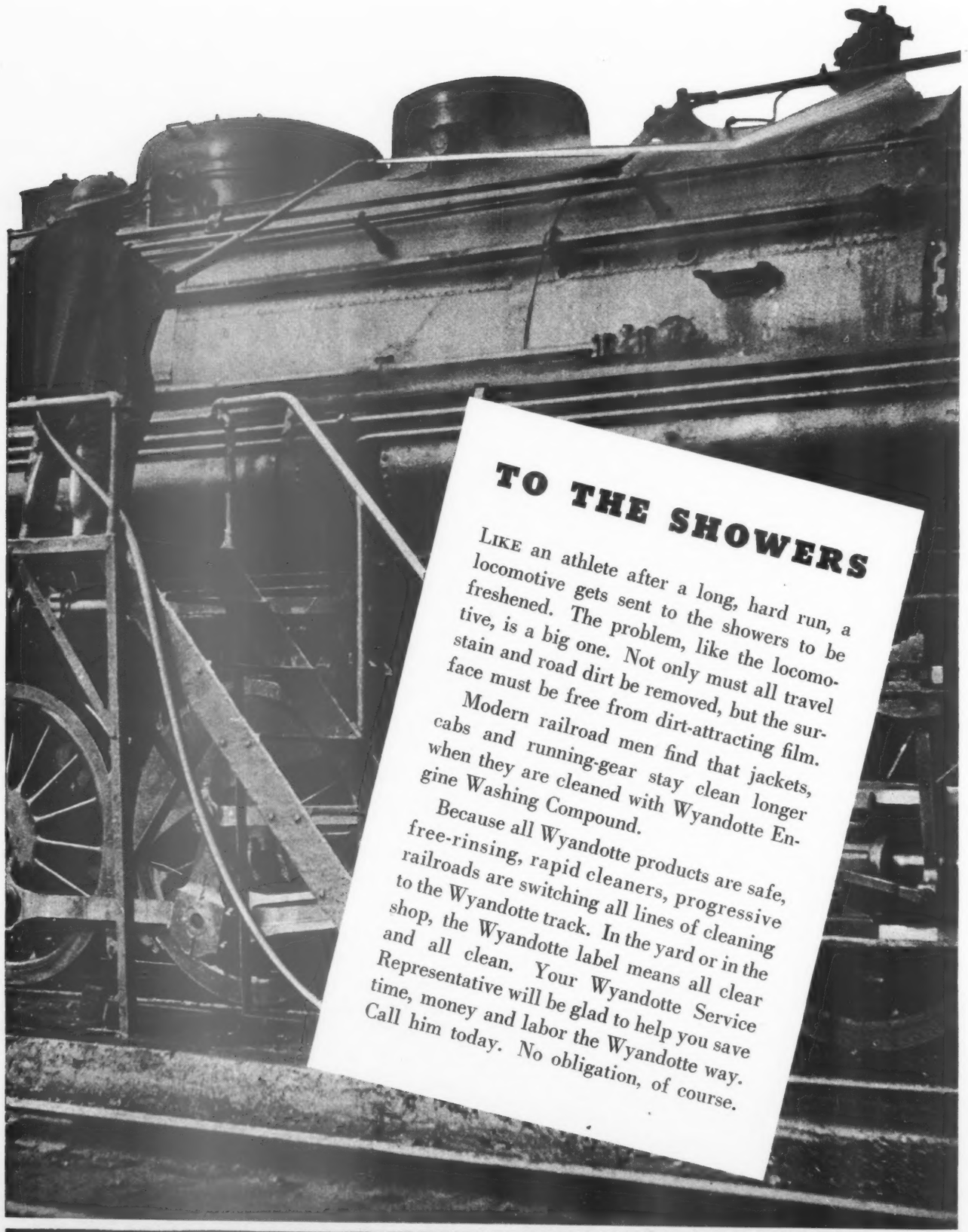


Illustration shows GARLOCK 150 spiral. If coil form is desired—specify GARLOCK 125. If cut rings are desired—specify GARLOCK 200.

WHY do so many thousands of engineers "prescribe" GARLOCK 150 High Pressure Packing—consistently year after year? Because they know from experience that GARLOCK 150 is *tough, strong, dependable.* They know it prevents costly shut-downs for frequent repacking. They know it saves money. For superior performance on piston rods of engines, pumps, compressors, expansion joints, etc., against steam pressures up to 300 lbs., standardize on GARLOCK 150.

THE GARLOCK PACKING CO., PALMYRA, N. Y.
In Canada: The Garlock Packing Co. of Canada Ltd., Montreal, Que.

GARLOCK 150



TO THE SHOWERS

LIKE an athlete after a long, hard run, a locomotive gets sent to the showers to be freshened. The problem, like the locomotive, is a big one. Not only must all travel stain and road dirt be removed, but the surface must be free from dirt-attracting film.

Modern railroad men find that jackets, cabs and running-gear stay clean longer when they are cleaned with Wyandotte Engine Washing Compound.

Because all Wyandotte products are safe, free-rinsing, rapid cleaners, progressive railroads are switching all lines of cleaning to the Wyandotte track. In the yard or in the shop, the Wyandotte label means all clear and all clean. Your Wyandotte Service Representative will be glad to help you save time, money and labor the Wyandotte way. Call him today. No obligation, of course.

Wyandotte

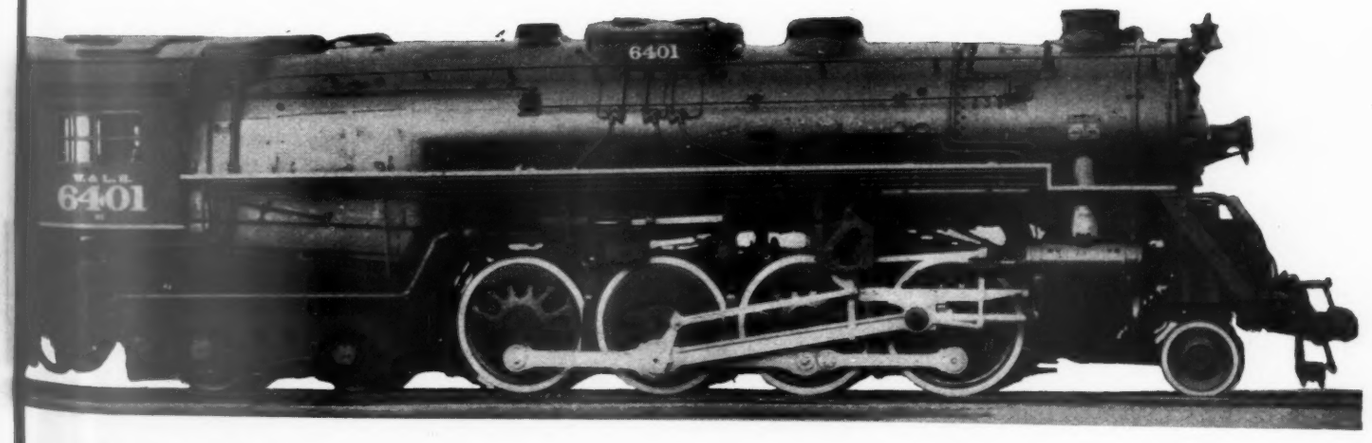
SERVICE REPRESENTATIVES IN 88 CITIES

THE J·B·FORD SALES CO· WYANDOTTE MICH

Repeat Order!

FIVE in 1938 and now seven more 2-8-4's for the Wheeling & Lake Erie—All equipped with installations of Hollow Flexible Staybolts. Repeat orders of this nature are highly significant of unusual economies.

FLANNERY BOLT COMPANY
BRIDGEVILLE PENNSYLVANIA



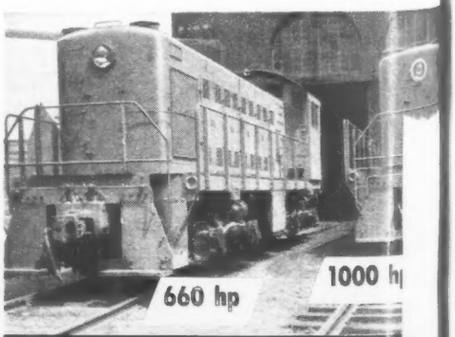
NEW G-E 44-ton Giant SAVES MORE THAN HALF Present Operating Costs

EVERY pound of this 44-ton diesel-electric locomotive is packed with earning power. Its unusually low operating cost (less than half that for a comparable steam locomotive) and its exceptionally high availability (as high as 98 per cent) make it a *real money saver.*

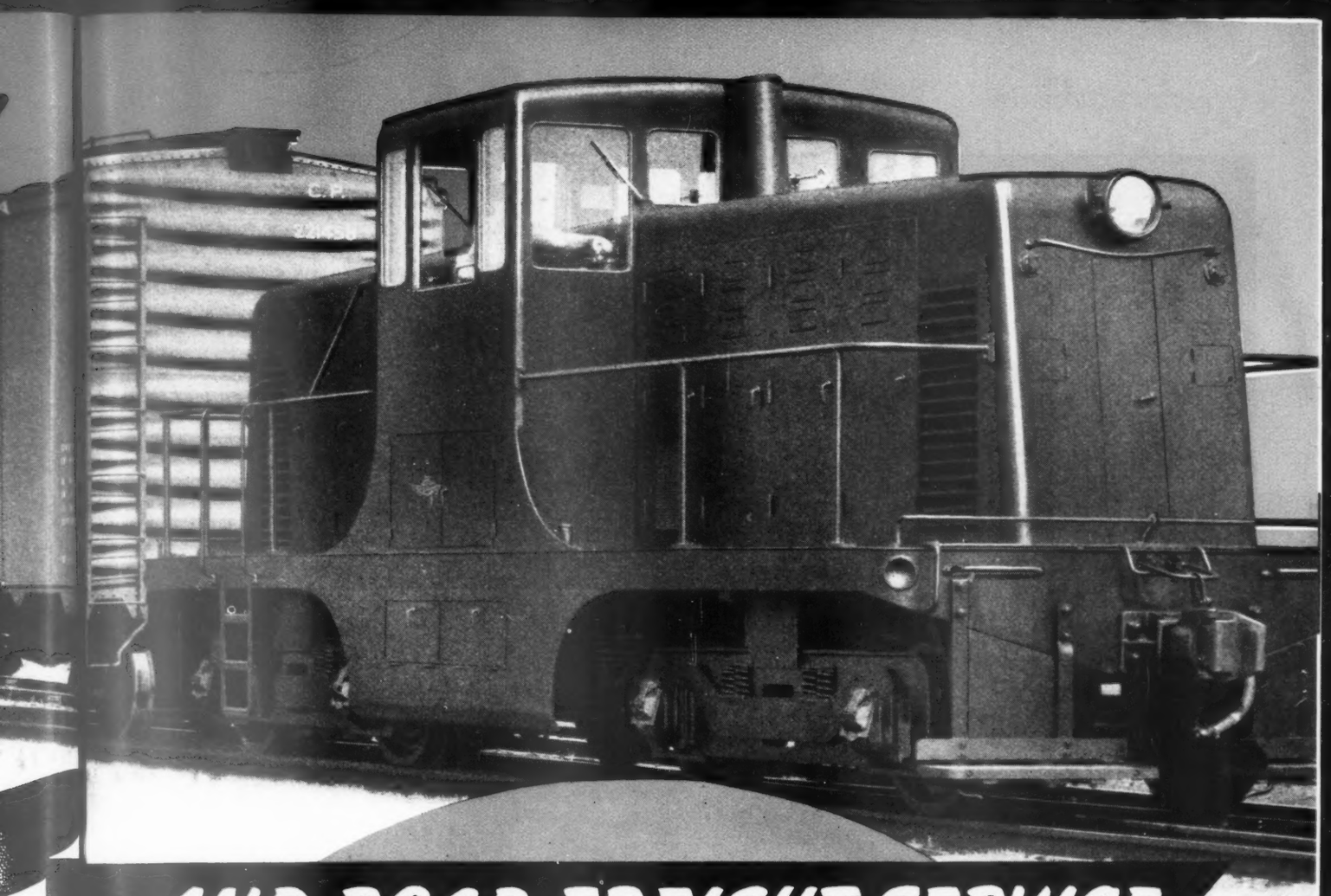
One of these units, replacing a steam locomotive in yard switching or road freight service, will usually earn a net return of 20 to 30 per cent. This does not include savings that result if you can eliminate expensive steam-locomotive facilities.

Careful estimates show that one of these locomotives, purchased recently, will pay for itself out of savings in less than three years.

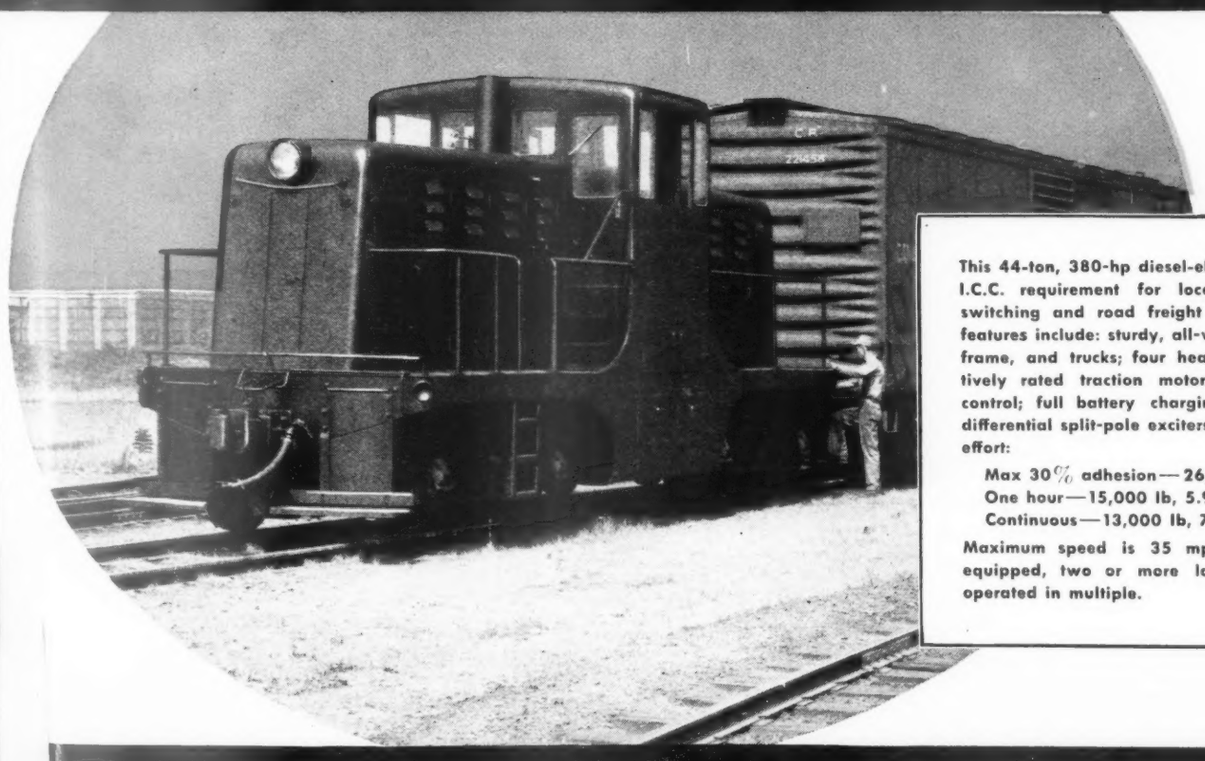
An experienced G-E transportation engineer will help you determine where these locomotives can satisfy *your* motive-power requirements most efficiently—and produce attractive savings. No obligation. Just see your G-E representative or write to General Electric, Schenectady, N. Y.



Fast, sturdy, reliable Alco-G.E. switchers will meet your requirements for heavier, more powerful locomotives.



AND ROAD FREIGHT SERVICE



This 44-ton, 380-hp diesel-electric meets every I.C.C. requirement for locomotives in yard switching and road freight service. Important features include: sturdy, all-welded cab, underframe, and trucks; four heavy-duty, conservatively rated traction motors; simple, flexible control; full battery charging at all speeds; differential split-pole exciters. Its rated tractive effort:

Max 30% adhesion — 26,400 lb
One hour — 15,000 lb, 5.9 mph
Continuous — 13,000 lb, 7.1 mph

Maximum speed is 35 mph. When suitably equipped, two or more locomotives can be operated in multiple.

GENERAL ELECTRIC

117-12

NILES
The NILES TOOL WORKS CO.
Time Saver TOOLS
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December 1940

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EQUALIZE BRAKE FORCES

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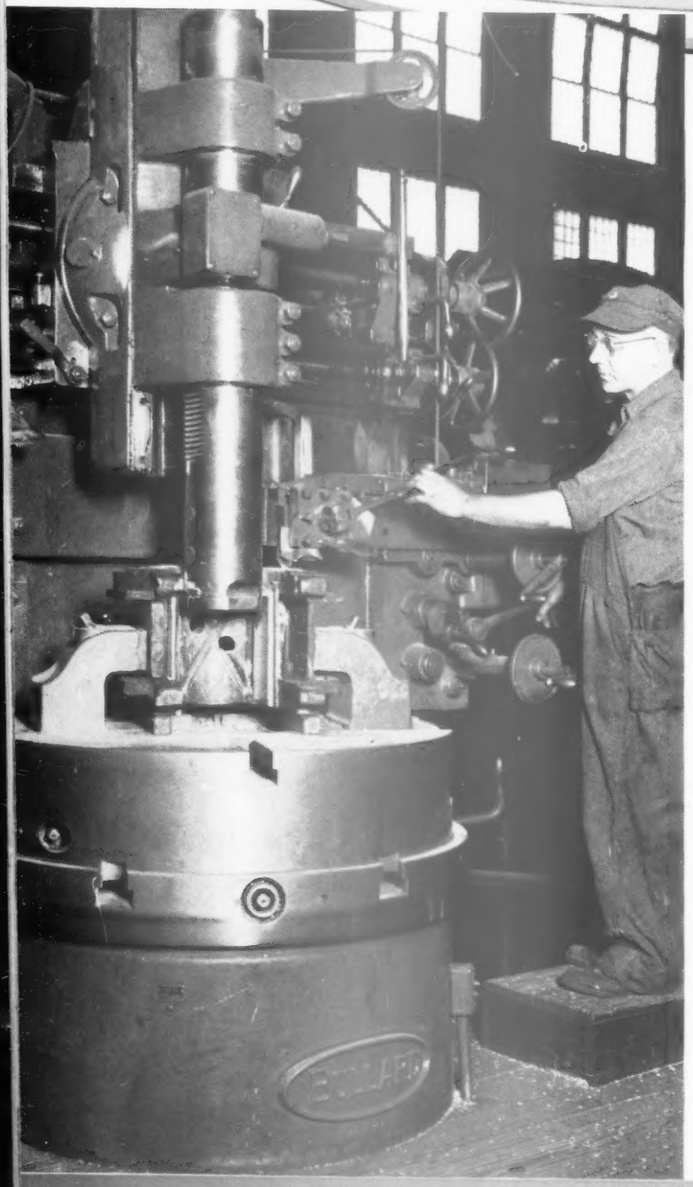
THE WINE RAILWAY APPLIANCE CO. TOLEDO, OHIO

TRANSPORTATION

BULLARD
Driving Box
BORER



Made for One Job...
and
What a Job It Does

FOR the back shops that have a sufficient amount of driving box boring jobs there is no other unit which begins to approach the production economies built into the BULLARD Driving Box Borer.

This unit is designed for driving boxes only. The extension adjustment in the main boring bar assures maximum support to the cutting tools and avoids excessive overhang.

A micrometer dial on the cross feed screw assures an accurate method of gaging the size in the bore.

Floor to floor time generally ranges from 9 to 15 minutes per box depending, of course, on the size and design of the job. The BULLARD line of R. R. Shop tools also includes a modified 42" V. T. L. for economical boring of driving boxes in small shops. Special attachments make it a very flexible unit.

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

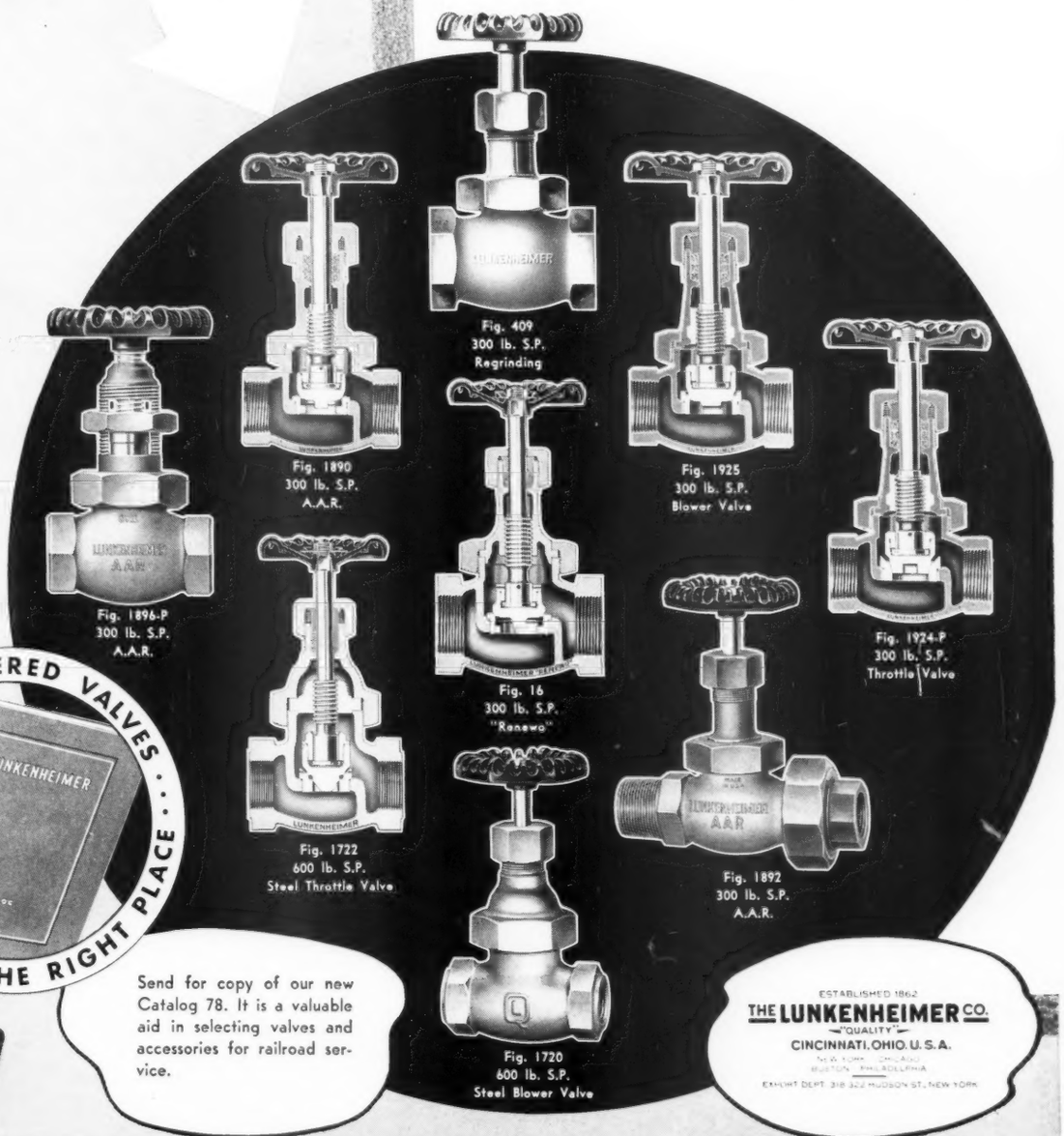
For Railroad Service

LUNKENHEIMER offers a wide variety of valves for locomotive and roundhouse service.

Illustrated are a few of the many bronze and steel types available — each "Correctly Engineered" for maximum safety and economy on its particular job.

A.A.R. patterns are made to A.A.R. specifications but with the inherent quality of all Lunkenheimer valves.

Standardize on Lunkenheimer for railroad requirements and be assured of trouble free, dependable valve service.



Send for copy of our new Catalog 78. It is a valuable aid in selecting valves and accessories for railroad service.

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THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI, OHIO, U.S.A.
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BRIDGEPORT, CONNECTICUT

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If you were to look long enough and were favored with luck, you might find one of the tremendous treasure chests which Captain Kidd and his bloody pirates cached long ago in some far away land. Needless to say, the chances of finding such a chest are as remote as the treasure itself.

But if you're really looking for treasure, you'll find plenty of it buried right here in America — once-profitable business . . . now buried under the dusty burden of antiquated machinery too old to keep pace with today's production tempo.

Your own business might be one of these. If it is, dig it up now. Rehabilitate it with new LeBlond machine tools. Make it a twentieth century, dividend-paying treasure chest. The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.